WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

A Scranton Gillette Publication

UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
COMP

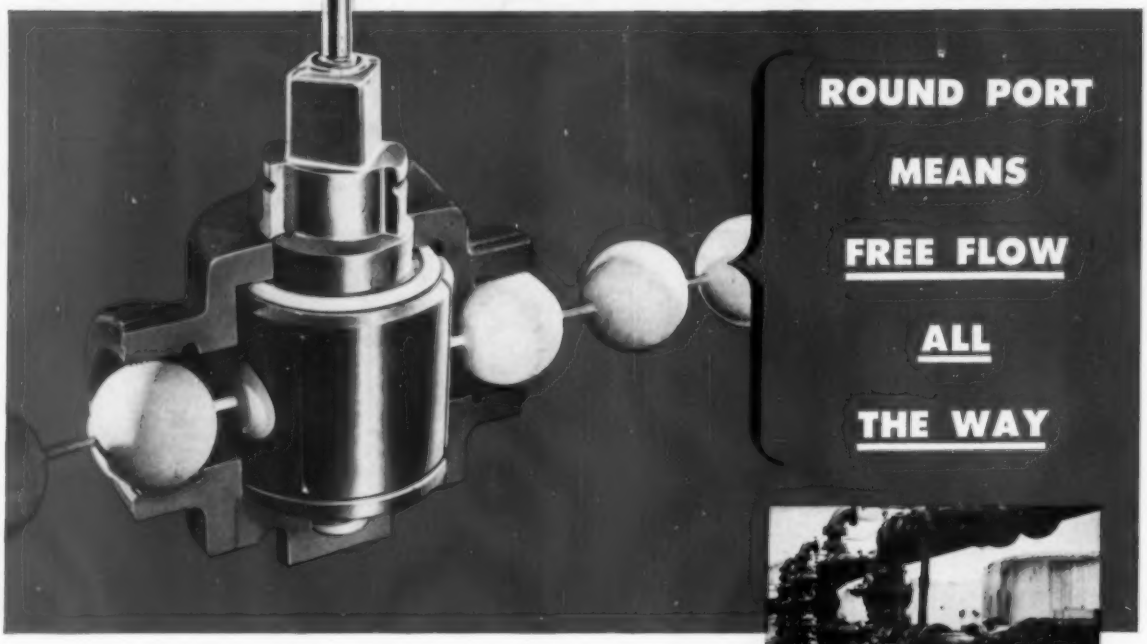
OCTOBER 1956

The Unique Filtration Plant at Corpus Christi, Texas
Across the open filters toward chemical building
(Pages 437-446)

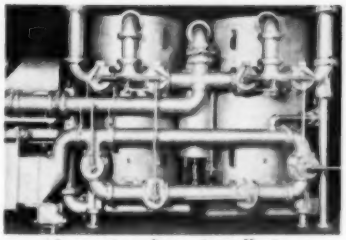
Sewage—A Raw Water Supply
(Pages 462-467)

Conservation of Ground Water
(Pages 468-473)

acf Lubricated Plug Valves



In salt water disposal plant.



Absorptive dryer installation.

In natural gasoline plant.

You get full volume, unrestricted flow throughout the entire piping system when you use acf Round Port Valves.

The pipe-matching port openings cause no loss in head pressure—offer no more resistance to flow than the pipe itself. There are no obstructions—no turbulence and no harmful abrasive effects from solids in suspension. Even the most heavy viscous ladings flow freely through acf Round Port Valves.

Split-second quarter-turn shutoff, non-wedging cylindrical plug, Teflon* head gasket, are additional advantages that add to perfect performance of acf Round Port Valves—that mean extra long trouble-free service—lower maintenance costs and fewer work stoppages.

Act now to step up valve performance—to keep maintenance costs down. Representatives in 50 principal cities.

* DUPONT TRADE NAME

W-K-M MANUFACTURING COMPANY, INC.

A SUBSIDIARY OF acf INDUSTRIES INCORPORATED

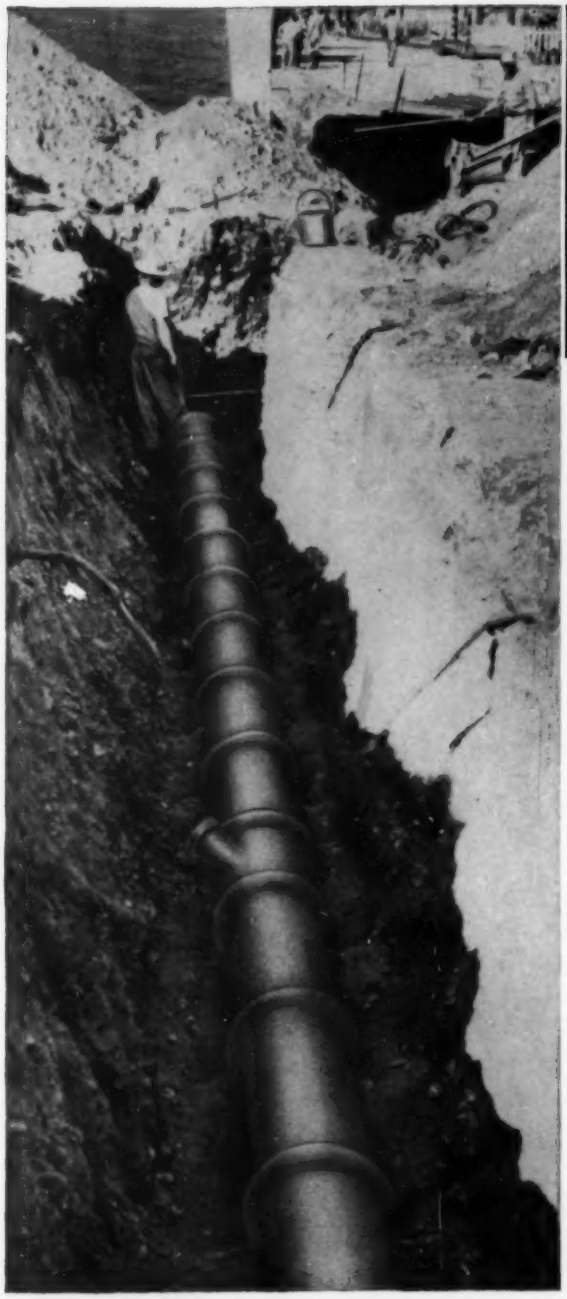
PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS



CLAY PIPE TRUNK SEWERS

Give Taxpayers More For Their Money!

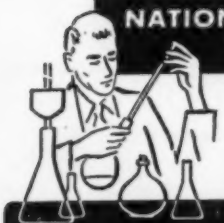
SAN BERNARDINO, CALIFORNIA recently installed another 40,000 feet of Vitrified Clay Pipe to serve the needs of its rapidly growing population. The new lines meet an urgent need because San Bernardino, "Gateway to the California Mountain Resort Areas," has expanded from 56,000 people ten years ago to more than 80,000 today. With the addition of this latest Clay Pipe project, the entire incorporated area of the city is now served by a modern sewerage system.

San Bernardino is giving its taxpayers the most for their money by installing the only pipe that never wears out. No matter how large the city may grow . . . no matter what industrial wastes may be introduced into the lines . . . Clay Pipe is *sure* to last. Chemicals can't corrode it—time can't weaken it—generations of constant use can't cause it to fail. Vitrified Clay Pipe safeguards public health *permanently.*

The "Del Rosa" and "Rialto Bench" trunk line projects at San Bernardino were designed by the Currie Engineering Co. Construction was carried out by the Encon Corp., Los Angeles.

Vitrified CLAY PIPE

C-656-1



NATIONAL CLAY PIPE MANUFACTURERS, INC.
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Tough Problem Solved

F&P Engineering solves Meyersville's problem: Higher fire insurance rates or safe water.

If all the property owners in Meyersville, Maryland were to avoid an increase in fire insurance rates, the main water pressure, during fire emergency, had to be maintained above the allowable minimum.

All other automatic proportioning Chlorinator systems recommended to Meyersville required permanent head losses far in excess of the allowable minimum or were prohibitively expensive.

All, that is, except the F&P Chlorinator. F&P, applying its wide instrumentation and systems engineering experience, utilized standard components to solve Meyersville's problem.

Since its installation the F&P unit has given accurate, maintenance-free, money-saving service.

If you have *any kind* of chlorination problem, why don't you call Fischer & Porter now? Write or call today—without obligation—for complete information and engineering data.

FP FISCHER & PORTER

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

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The New Water Purification Plant of Quito ..... *Bunker*
Philadelphia's Incentive Pay Plan Boosts Meter Shop Output ..... *Arnold*
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WATER AND SEWAGE WORKS is published monthly with an extra issue in June. Subscriptions including the Reference and Data issue in the U.S. and Canada, 1 year $3.00; 2 years $4.50; 3 years $6.00. Other countries $1.50 per year additional. Single copies 25¢ except Reference and Data issue 50¢.

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Water and sewage budgets

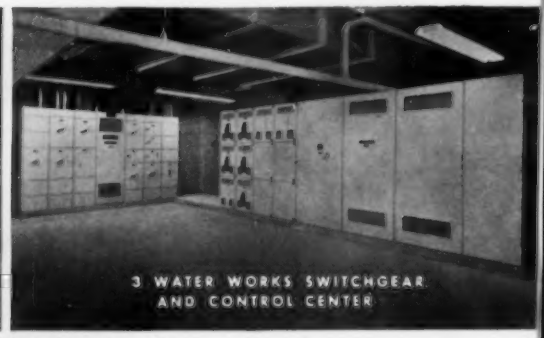
As a planner of water and/or sewage plants you know what it means to be in the middle, between a demanding public on one side and budgets shrunk by increasing costs on the other.

Westinghouse can help you get the most out of each shrinking dollar in a realistic way. First by providing everything you need electrically in one integrated line. It's simpler, surer, that way.

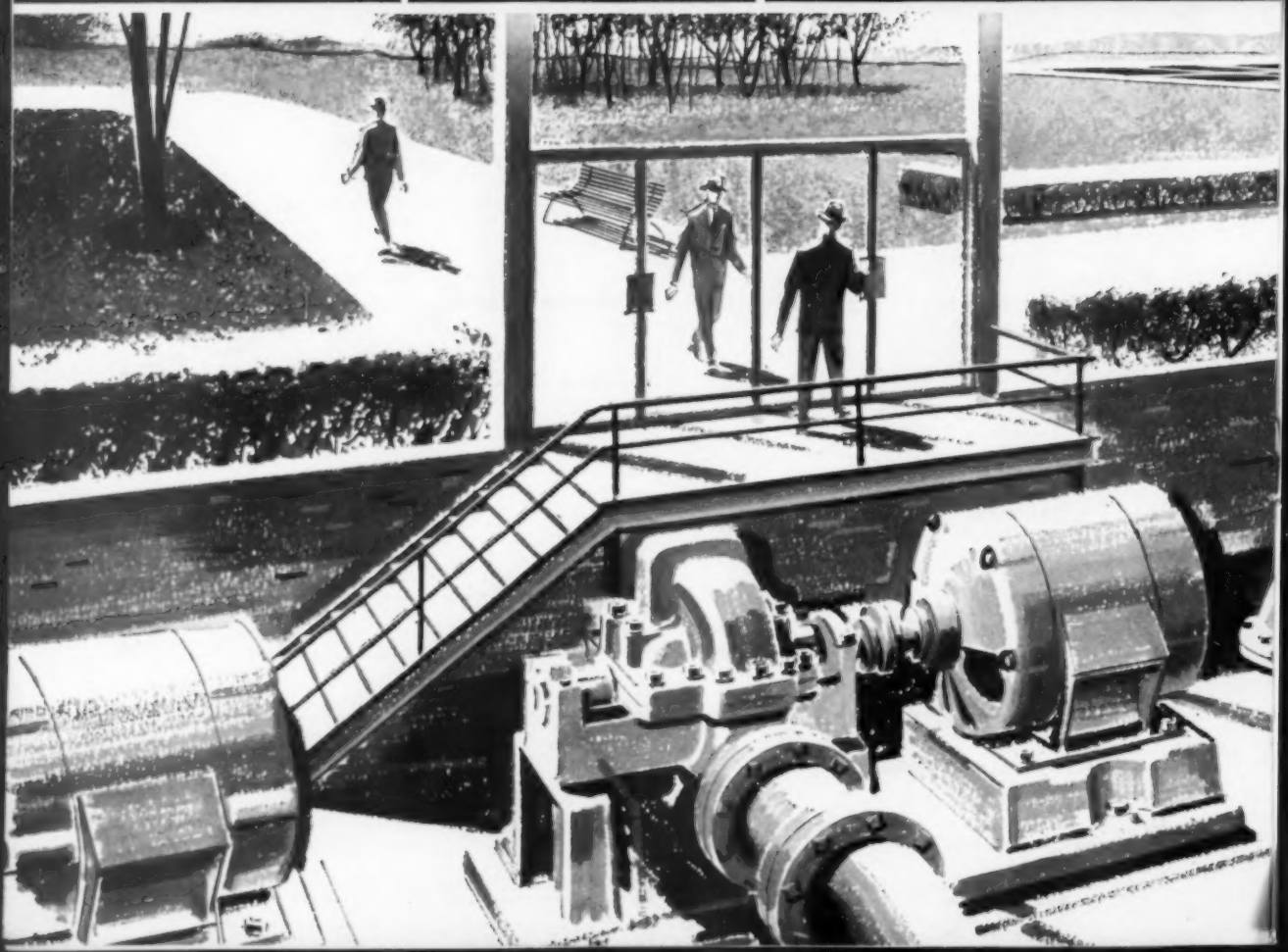
Further, by making available a specialist engineer on problems of power distribution for all kinds of proj-

1 SEWAGE SYSTEM SWITCHGEAR — CONTROL CENTER

2 CONTROL CENTER FOR SEWAGE PLANT



3 WATER WORKS SWITCHGEAR AND CONTROL CENTER



can be stretched electrically

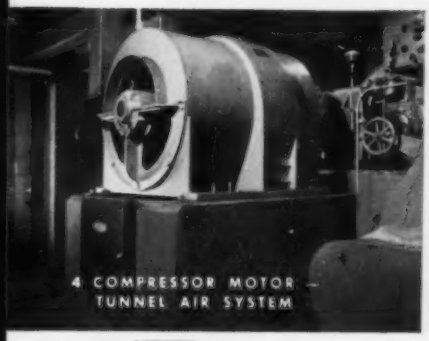
ects, power distribution systems, switchboards, motor applications, controls of every type, interior or area lighting . . . anything electrical.

There is a Westinghouse electrical construction engineer in your area who will head up a team of such specialists when you or your consultants want help on electrical specs that will stretch the budget. He's as close as your telephone. Call him.

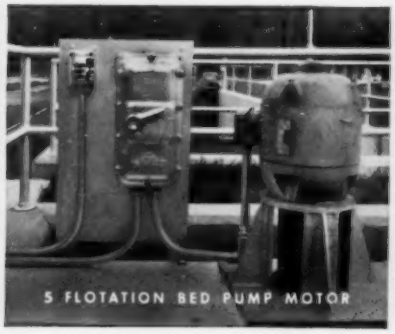
Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94066

1. This close-coupled assembly of Westinghouse "drawout" switchgear and control center serves the modern sewage treatment plant at Bloomsburg, Pa. **2.** Another control center at Bloomsburg. All units were factory-assembled and pre-wired. **3.** Incoming power for the Houston, Texas, water purification plant is received in the 1000-kva, 4160/480-277-volt power center at right. Power control at left has 480-277-volt power section, 150-kva dry-type transformer and a 120/208-volt lighting section. **4.** 1000-hp Westinghouse motor driving a Freon compressor for vehicular tunnel air system. **5.** Vertical-type circulating pump for flotation beds in a Cincinnati, Ohio, sewage plant driven by 100-hp Westinghouse Life-Line® motor. **6.** Typical area lighting with Westinghouse OV luminaires. Harmonious modern design, brilliant illumination, low maintenance.

WATCH WESTINGHOUSE *COVER THE PRESIDENTIAL CAMPAIGN ON CBS TELEVISION AND RADIO!*

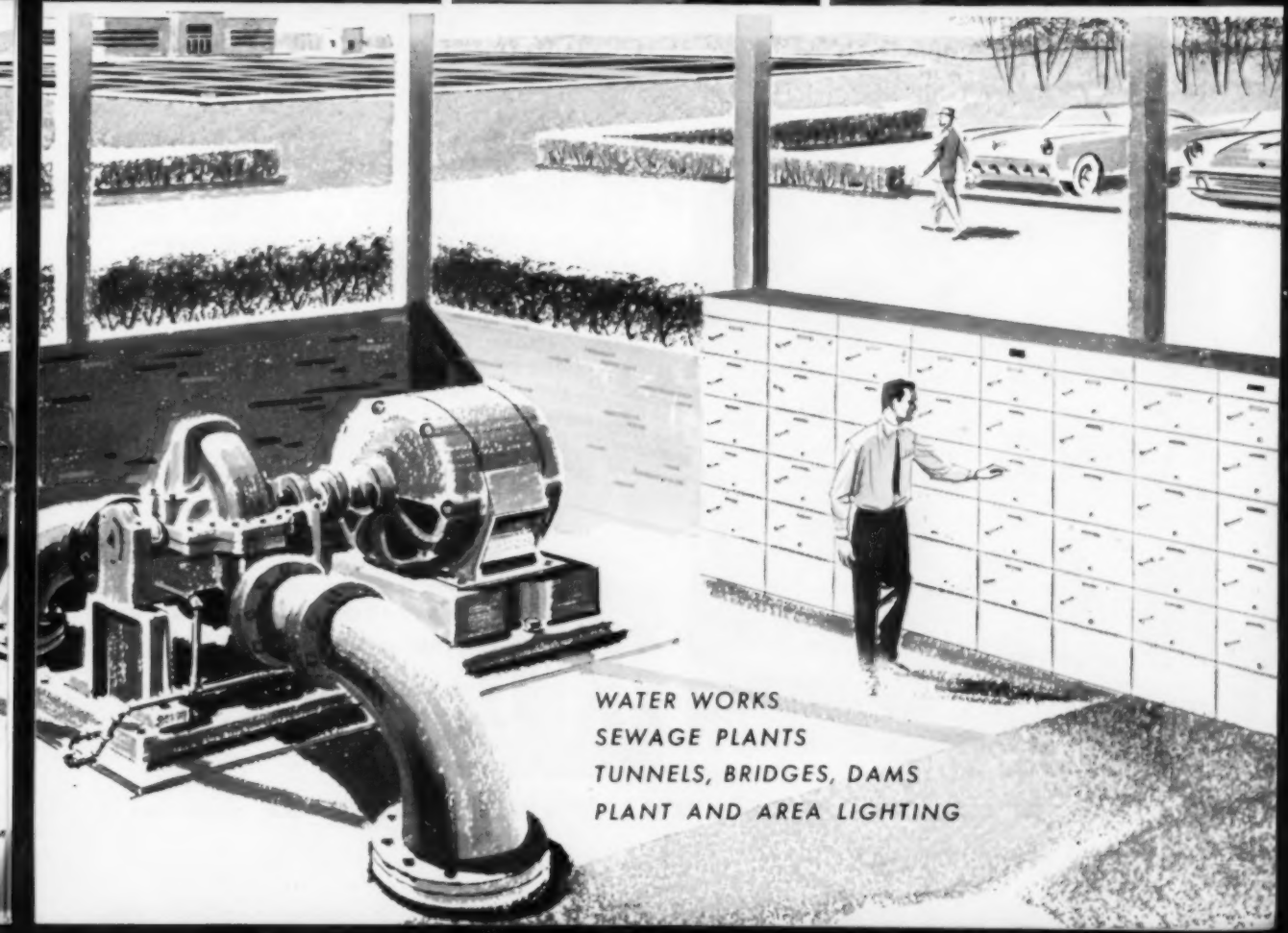


4 COMPRESSOR MOTOR — TUNNEL AIR SYSTEM



5 FLOTATION BED PUMP MOTOR

6 PUBLIC WORKS AREA LIGHTING SYSTEM



WATER WORKS
SEWAGE PLANTS
TUNNELS, BRIDGES, DAMS
PLANT AND AREA LIGHTING

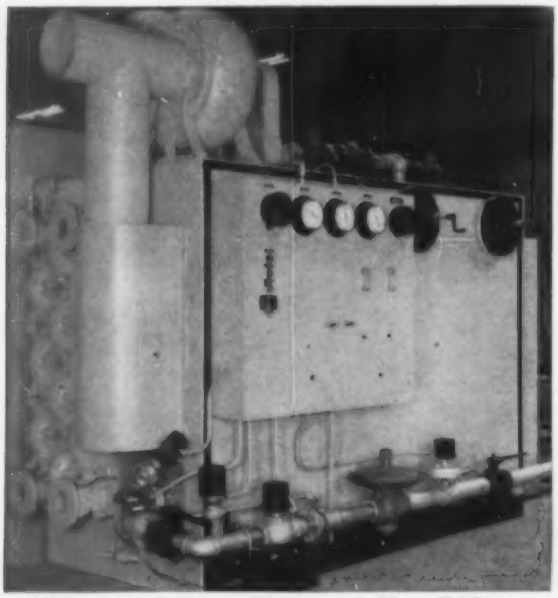
At Tacoma, Washington . . .

This Gleaming New Plant is Run at Peak Efficiency

WITH MODERN PFT EQUIPMENT

Sparkling clean and beautifully landscaped, Tacoma's new primary sewage treatment plant is a model of modern treatment methods and efficient operation. Completed in 1952, it uses PFT equipment for *effective treatment* and *more convenient operation.*

For the digestion tank, a *PFT 75′ Floating Cover* was installed for positive scum submergence and more flexible capacity (the cover simply rises or lowers with additions and withdrawals). The snug fitting cover eliminates odor and fly nuisance, and explosion hazards are reduced because gas collected under the cover is maintained at positive pressure under all operating conditions.



PFT #1000 Digester Heater and Heat Exchanger

For added convenience, a *PFT Cover Position Indicator* in the Control Building tells the operator at a glance the position of the cover.

A *PFT Heater and Heat Exchanger* unit automatically provides building heat and maintains close temperature control of the digester. Fired by gas *or* oil, it cuts fuel costs substantially by utilizing all gas produced in the digester. Tacoma's efficient digester operation is largely due to this close, automatic heat control!

Other PFT equipment in the new plant includes the following Gas Safety equipment—Heater Flame Trap; Pressure Relief Waste Gas Flame Trap; Waste Gas Burner; Pilot Line Flame Cell; Drip Traps.

The Tacoma plant's success results from close cooperation among three key men—C. S. Seabrook, Sanitary Engineer; Louis E. Fox, City Engineering Department; and Lyman Ketcham, Chief Operator.

Design of plant by / Engineering Office of Clyde C. Kennedy

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

Trenching like this will cut your costs, too!

Bill Lechner of the Budrovich Excavating Co. of St. Louis County, Mo., digs 510-ft. of trench 7 ft. deep in just 5 hours! That, he says, is about his average production with the Oliver 88 Hydro-Trencher. And he's talking about some of Missouri's toughest gumbo!

Fuel consumption on this work averages 18 gallons for 12 hours of hard digging. That's real economy for a ½-yd. machine that piles up yardage this way. Maintenance? After 7 months of steady work, he reports no service problems beyond normal check-ups.

The Hydro-Trencher's tremendous down pressures make it easy to cut through the toughest soils. Two separate hydraulic control circuits permit you to raise or lower the bucket while swinging. Or open and close the bucket as you raise or lower—all with smooth, accurate control. It gives you much faster digging and loading than with ordinary equipment of this type.

Why not start cutting your own costs, *now?* Your dependable Oliver distributor has the facts you'll want. Call him today.

THE OLIVER CORPORATION

400 West Madison Street, Chicago 6, Illinois

a complete line of industrial wheel and crawler tractors and matched allied equipment

'Red Water' doesn't live here any more!

No more 'Red Water'—thanks to Threshold Treatment with Calgon*—that's the record in this typical community.

When Calgon treatment was started, 'Red Water' stopped, and now everyone is complimenting the water superintendent.

Calgon in very small amounts is effective against 'Red Water' because it not only stabilizes iron and manganese dissolved in water at its source, but it also prevents iron pickup from pipes.

Calgon stops lime scale, too, by forcing calcium carbonate and other scale-forming chemicals to stay in solution, even when the water is heated. Calgon is used in minute amounts, and the reduction of lime scale means important savings in keeping equipment and meters clean.

Call on Calgon for the economical solution to your specific problem. Many years of experience with water problems of all kinds in every part of the country are at your service.

*Calgon is the Registered Trade Mark of Calgon, Inc. for its glassy phosphate (sodium hexametaphosphate) products.

HAGAN

calgon, inc.

A Subsidiary of Hagan Corporation
Hagan Building • Pittsburgh 30, Pa.

Photo and Report by Interstate Industrial Reporting Service

Georgia red clay — often studded with quartz and granite — "routine" for Cleveland owner

CONCRETE CONSTRUCTION CO. of Atlanta, Georgia, recently completed a trench excavating job for the installation of a gas main in the North Druid Hills near Atlanta. "This area," says a report from C. V. Lanier, field superintendent for Concrete Construction, "contains quartz and—since the spine of Stone Mountain underlies the district —chunks of granite. But, using one of our Cleveland 95's, we consider it just a routine job." Concrete Construction currently operates nine Clevelands, three 92's, four 95's and two 110's. Mr. Lanier's report continues:

"Trencher operations constitute the basis of our business—and to us that means Clevelands. Mechanically, we have never had a Cleveland halt in the field."

Performance like this proves again that Clevelands dig *more trench . . . in more places . . . at less cost.* Talk it over with your Cleveland distributor.

Good Everywhere

THE CLEVELAND TRENCHER COMPANY

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

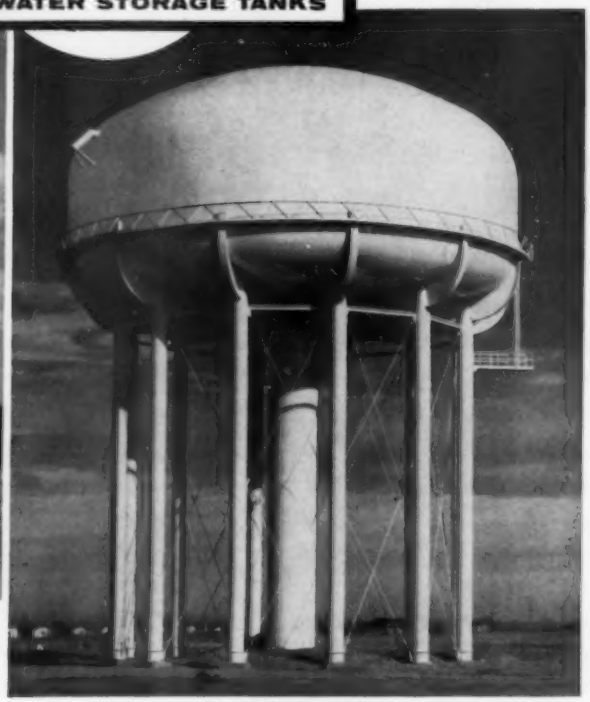
750,000 gallons capacity. Tank diameter 62 ft. Head range 35 ft. Height to bottom 120 ft.

The long and the short of

BETTER WATER SERVICE IN *Pueblo, Colo.*

PDM

WATER STORAGE TANKS



1,500,000 gallons capacity. Tank diameter 88 ft. Head range 35 ft. Height to bottom 70 ft.

Balancing the water service requirements of the City of Pueblo, Colorado, these strategically-located Pittsburgh-Des Moines Radial Cone Elevated Steel Tanks provide, with a 50-ft differential in tower heights, uniform water pressures over a large service area. Dependable supply is coupled with low head-range in this large-capacity tank type. Ask for our latest Catalog covering the complete range of PDM Elevated Steel Tanks.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES, SANTA CLARA, FRESNO, and CADIZ, SPAIN

PDM WATER STORAGE TANKS

Sales Offices at:

PITTSBURGH (25) ....3416 Neville Island
NEWARK (2) ....218 Industrial Office Bldg.
CHICAGO (3), 1222 First Natl. Bank Bldg.
EL MONTE, CAL. .....P. O. Box 2068
DES MOINES (8) ..919 Tuttle St.
DALLAS (1) 1223 Praetorian Bldg.
SEATTLE .....526 Lane Street
SANTA CLARA, CAL., 648 Alviso
MADRID, SPAIN ...Diego DeLeon, 60

Let us remember the mountains of Attica and not abandon our land

"There are mountains in Attica which can now keep nothing . . . but which were clothed, not so very long ago, with fine trees producing timber . . . while the country produced boundless pasture for cattle . . ."

As early as 300 B.C., when Plato thus lamented a tragedy of exhausted natural resources, there was little left of Attica's fertility — only insects crawling about the *"sites of extinct water supplies."* A lesson 2000 years old, to be heeded if we would escape the fate of Attica.

And the first logical step in vital water conservation is to replace flat, waste-conducive rates with Badger Metering.

The demand for water is at its peak in our history. All classes of users compete for more and *more*. A 75% increase in consumption is expected by 1975. In some areas the situation is already critical.

Curtailing waste with Badger Meters — fairly apportioning the responsibility and accounting for water use — is not only a sound investment in your community's future, but essential to its very survival.

The time to act is now — while there's still some water left to save! Write today for information on Badger Meters, or to arrange for a representative to call.

Badger Water Meters

Badger Meters have conserved it for 50 years

BADGER METER MFG. CO. MILWAUKEE 45, WISCONSIN

WEMCO TORQUE FLOW SOLIDS PUMP

If you want a truly "Never Clog Pump" specify as follows:

"Pump shall be of the non-clogging vortex type with recessed impeller mounted completely out of the flow path between pump inlet and discharge connections to enable passage of solids particles equivalent to discharge pipe diameter."*

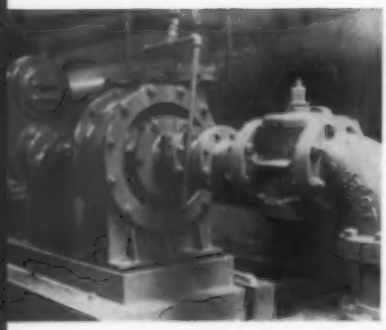
*Taken from consultants specifications for sewage and sludge pumps.

FOR LIFT STATION SERVICE:

Unattended, continuous operation is the standard operating procedure with Wemco Torque Flow Solids Pumps. Bar screens are eliminated. Frequent inspections are not required. Costly maintenance is eliminated. "Never clog operation" is inherent in the pump's design.

At Torrance, California

General Specifications:
Sizes: 3" through 8"
Material: Cast Iron
Capacities: 50 GPM to 2500 GPM
Heads: Up to 100'
Necessary Clearance Adjustment: None
Models: Horizontal or Vertical (Most sizes)
Drive: V-Belt, Varidrive or direct connected (Most models)



FOR SLUDGE PUMPING: TRANSFER OR RECIRCULATION, RAW OR DIGESTED

Sludges with high percentage of solids are handled without blockage. Suction lifts are extremely high at both high and low volume. Long wear life of parts and complete freedom from clogging on rags and fibers prevents down time losses and high maintenance.

At Rockaway, New York

General Specifications:
Size: 2" through 8"
Material: Cast Iron or Ni-Hard
Capacities: 50 GPM to 2500 GPM
Heads: Up to 100'
Necessary Clearance Adjustment: None
Models: Horizontal or Vertical (Most sizes)
Drive: V-Belt, Varidrive or direct connected (Most models)

FOR GRIT HANDLING OR DIGESTER CLEANOUT:

Wemco Solids Pump never clogs either in continuous or intermittent operation. Long wear life and no blockage combine to provide the ultimate in overall low cost material handling.

At Los Angeles County, California

General Specifications:
Sizes: 2" through 8"
Material: Ni-Hard
Capacities: 50 GPM to 2500 GPM
Heads: Up to 100'
Necessary Clearance Adjustment: None
Model: Horizontal only
Drive: V-belt or Varidrive

On Sanitation Pumping Problems consult your local Wemco representative:

Atlanta 5, Georgia,
W. D. Taulman & Associates,
P. O. Box 436, Northside Branch
Baltimore 1, Maryland,
Stuart Corporation,
516 North Charles Street
Boston (Newton Lower Falls, Massachusetts),
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St. Louis, Missouri,
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3938 Lindell Boulevard
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2045 Marshall Avenue
Toronto 9, Ontario,
United Steel Corporation, Ltd.,
Sanitation Equipment Division
Tulsa 3, Oklahoma,
Bagwell Company,
102 East Ninth Street

Wemco's Torque Flow design has been responsible for many outstanding "never clog" records. The principle is fully explained in available literature. It will save you thousands of dollars in operating costs. For further details contact our representative in your area or write direct.

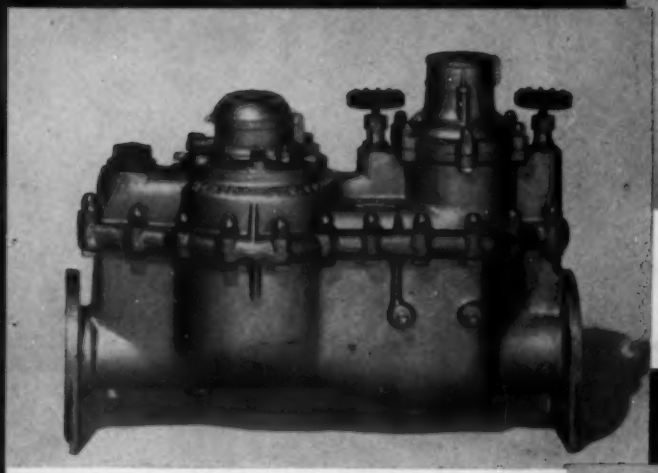
WEMCO
WESTERN MACHINERY COMPANY

WESTERN MACHINERY COMPANY
764 Folsom Street, San Francisco 7, California

Representatives in principal cities of the United States and Canada and in major countries throughout the world.

HERSEY DISC WATER METERS

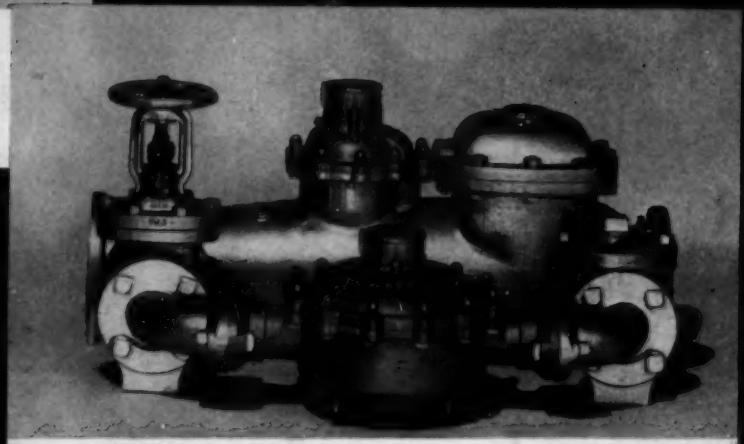
for domestic services



HERSEY

COMPOUND WATER METER

All bronze case 2" to 6" inclusive



HERSEY DETECTOR (Fire Service) **METER**

with DISC METER on BY-PASS

Also furnished with All Bronze Case Compound Meter on By-Pass for special types of service

For all types of efficient Water Meter Service

HERSEY WATER METERS

have never been surpassed for accurate registration and low maintenance costs.

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

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For complete, modern pipe line equipment to meet virtually all your needs, be sure to call on Pollard! *More than a century of service and experience are behind each of the one-hundred-twenty-six equipment categories listed in the new Pollard Catalog.*

Hundreds of Pollard customers depend on Pollard for prompt delivery of highest quality pipeline equipment, backed by the most cooperative service in the industry.

PLACE YOUR NEXT ORDER WITH POLLARD. Look up the Pollard Catalog, or write for a new copy. Ask for Catalog 26.

PIPE LINE EQUIPMENT

JOSEPH G. POLLARD CO., INC.

PIPE LINE EQUIPMENT

PIPE LINE EQUIPMENT

If it's from POLLARD . . . it's the Best in Pipe Line Equipment

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Branch Offices: 1064 Peoples Gas Building, Chicago, Illinois
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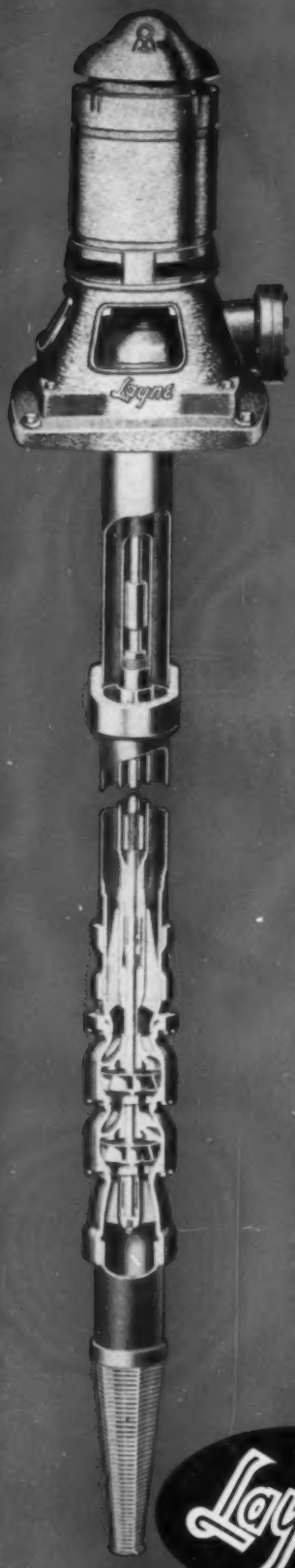

There are Many Reasons for World Leadership of...

Layne

VERTICAL TURBINE PUMPS

Tested and proved in thousands of installations of all types, the world-wide leadership of Layne pumps has led the field for one overall reason—PERFORMANCE . . . under all kinds of operating conditions.

That envied, but never duplicated, performance record has been made for many reasons. These are a few:

1. Complete and undivided manufacturing responsibility: Every part of every Layne pump is manufactured in the Layne factory to Layne high standards.
2. Concentration on one make: A lifetime of experience is behind every Layne pump . . . and that accumulated "know how" is focused on one pump alone.
3. Proven design: The basic design of a Layne pump has been job tested under every conceivable operating condition. And that design is converted into a finished unit through a series of highly specialized and quality-controlled factory operations.

To know all the reasons why Layne pumps are preferred by Industry—Municipalities—and Agriculture, write for bulletin number 100.

LAYNE & BOWLER, INC.
MEMPHIS
General Offices and Factory

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Layne

Water Wells • Vertical Turbine Pumps • Water Treatment

ECONOMICAL

WATCH-DOG METERS

year after year, utmost accuracy, with little or no upkeep

It will pay you, in the long run, to buy "WATCH-DOG" meters. Their excellence of design, their precision parts — always interchangeable — their long, dependable life—all add up to true economy. Maintenance is at a minimum with "WATCH-DOG" meters. Our nearby sales office is at your service. Literature mailed to you upon request.

SPLIT CASE
OR
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WORTHINGTON-GAMON METER DIVISION

Worthington Corporation

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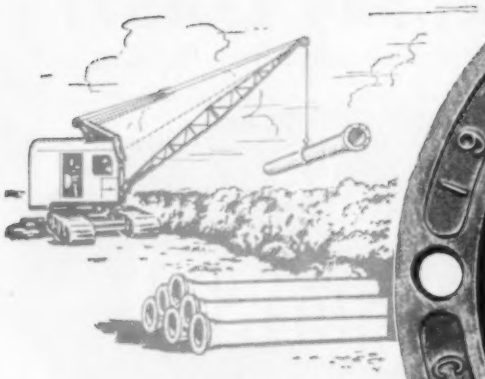
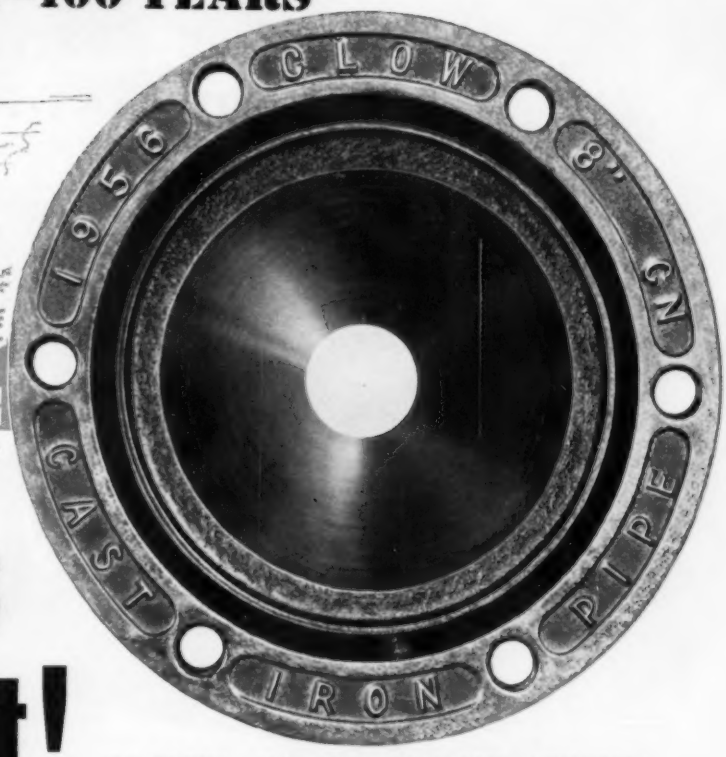
OFFICES IN ALL PRINCIPAL CITIES

CAST TO LAST–100 YEARS





let's face it!

CLOW CAST IRON PIPE MEETS ALL REQUIREMENTS

When you lay pipe underground
it must be strong . . . tough . . . uniform . . . and durable.
Before specifying pipe for your system, consider these 10 fundamental requirements for any underground pipe for water service.
Clow Cast Iron Pipe meets them all!

LONG LIFE—proved to be 100 years and more
BURSTING STRENGTH—for working pressure plus water hammer
TOUGHNESS—to resist shock and impact
TENSILE STRENGTH—to withstand high bursting pressure
BEAM STRENGTH—to withstand trench and traffic loads
COMPRESSIVE STRENGTH—to resist crushing loads
IMPERVIOUSNESS—no leakage, seepage or sweating
TIGHT JOINTS—of proved dependability
TAPPING STRENGTH—for strong, clean threads
FLOW CAPACITY—large, smooth bore for maximum flow

SINCE 1878

JAMES B. CLOW & SONS, Inc.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:
Eddy Valve Company, Waterford, New York
Iowa Valve Company, Oskaloosa, Iowa

Multiplies Bearing Contact Area by SIX... *AT LEAST!*

CHAPMAN'S Beamed Waterway GATE VALVE

With Chapman's Beamed Waterway Valve, in the partly open position, you get *six to ten* times more bearing contact surface. That's six to ten times more bearing contact surface than you could get from any other double disc parallel seat or square bottom gate valve. No wonder it leads the preferred list for Filtration Plants, Wash Water Service, or other similar limited throttling use.

Operation is smooth. They seat snugly. There's little or no leakage. Bronze bearing surfaces on beams and downstream discs are rugged. Their long useful life . . . with top-notch performance and lowest maintenance . . . is measured in decades, not just years. This applies to all sizes . . with any desired method of operation.

Outside of a stamp, it costs nothing to get all the facts. You'll find them in our Catalog No. 45 . . . an informative digest devoted exclusively to Chapman Beamed Waterway Gate Valves.

Why not write for it . . . now!

THE CHAPMAN VALVE MANUFACTURING COMPANY

INDIAN ORCHARD, MASSACHUSETTS

CONCRETE PIPE

provides strength, durability and economy for:

WATER LINES. Concrete pipe's great structural strength, tight joints and uniformly dense structure prevent leakage. There is no tuberculation and less incrustation to impair hydraulic efficiency. Concrete pipe minimizes taste, odor and dirty water difficulties and is not affected by electrolysis.

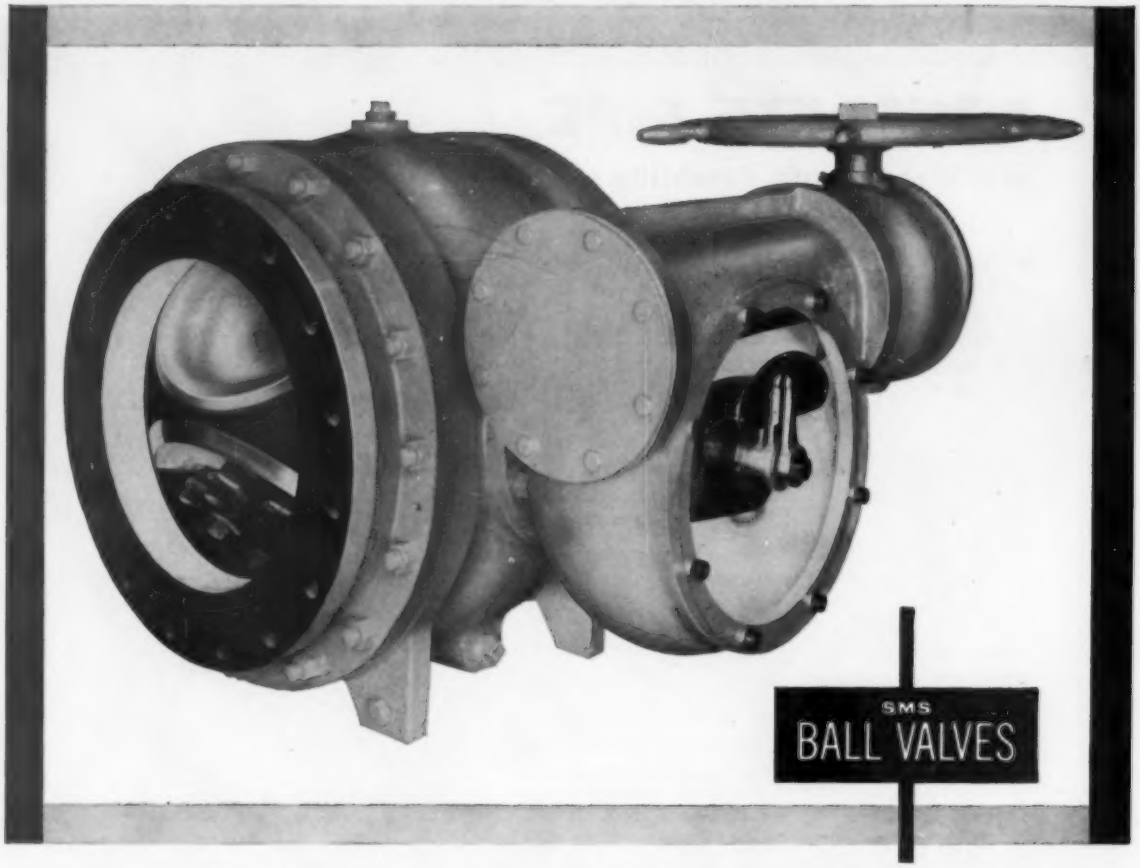
SEWERS. Concrete pipe sewers have served for more than 100 years. They have the durability to render years of economical service, the strength to sustain heavy overburdens. Their smooth interior finish resists abrasion, assures maximum carrying capacity.

CULVERTS. Concrete pipe provides real economy in culverts. It is a good investment because of its moderate first cost and exceptionally long life. Concrete pipe culverts have been proved by long service under thousands of miles of federal, state and county highways and roadbeds of many leading railroads.

PORTLAND CEMENT ASSOCIATION

33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work



FLOW ITSELF HELPS MAKE SMS BALL VALVES EASY TO CLOSE

Flow velocity actually assists the closing operation of SMS Ball Valves. With the hydraulic action boosted by the powerful leverage of the simple link and lever mechanism (visible through the lucite cover of the demonstration model above), the valve is remarkably easy to close. The wedging action of the metal-to-metal seats assures drop-tight closure.

In the open position, the valve is like a straight length of pipe. Pressure drop and turbulence are kept to a minimum, resulting in lower pumping costs and longer valve life.

The high quality and performance characteristics of SMS valves are guaranteed by more than 75 years of research and engineering. To get detailed information about our complete line of Ball Valves, Rotovalves and Butterfly Valves, contact your local representative, or write to the S. Morgan Smith Company, York, Pennsylvania.

SMS

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

HYDRAULIC TURBINES · GATES & HOISTS · TRASH RAKES · PUMPS · ACCESSORIES

HYDRODYNAMICS

ROTOVALVES · FREE DISCHARGE VALVES · BALL VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS · BUTTERFLY VALVES

Modern water filtration plant, Marietta, Ga. Pipe and fittings were supplied by the American Cast Iron Pipe Company

American Cast Iron Pipe

36" American Bell and Spigot Pipe laid out for installation in a Mid-western city.

30" American Double-X Mechanical Joint Pipe laid on piers. High pressure feeder main at a Southern city.

Municipal officials and engineers are familiar with the requirements for good water and sewage service. American Cast Iron Pipe company engineers and metallurgists are equally familiar with the exacting requirements for successful piping installations. As a result, American Cast Iron Pipe has been the repeated pipe choice in thousands of communities.

There are good reasons. First, American Cast Iron Pipe meets all requirements—for high flow capacity inside the pipe, for durability and reliability both externally and internally, and for economy in both installation and maintenance costs.

Second, there is an American centrifugally cast pipe for every service condition . . . pipe specifically designed and manufactured to meet or exceed the requirements of the job.

Third, American Cast Iron Pipe Company service meets all requirements, as well.

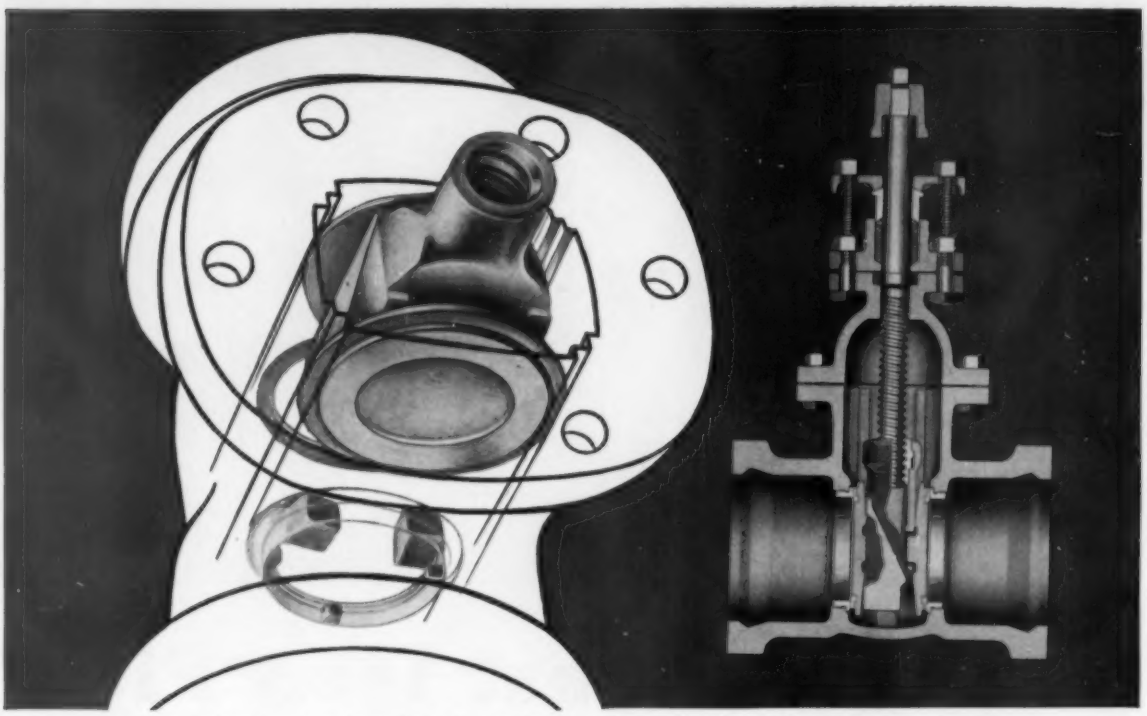
There are many other good reasons why American Cast Iron Pipe is a favorite with engineers and municipal officials. Get acquainted with your American Cast Iron Pipe Company representative. He knows pipe — inside and out.

AMERICAN

AMERICAN
CAST IRON PIPE CO.
BIRMINGHAM 2, ALABAMA

SALES OFFICES

New York • Chicago • Cleveland • Denver • Dallas • Minneapolis • Houston • Orlando Pittsburgh • Kansas City • San Francisco • Los Angeles



The outline drawing shows how the simple, 4-piece disc assembly is held in alignment by the guide ribs. As the disc assembly descends on the stem, the lower spreader strikes a boss in the body. Further closing movement exerts pressure on the spreaders in a wedging action, forcing the parallel discs tightly against the seats.

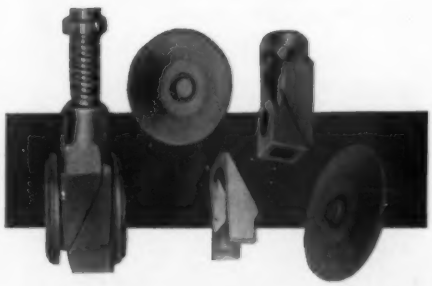
New Crane disc assembly and guide rib design improve efficiency of AWWA valves

Two design features—a simple, 4-piece disc assembly and a unique guide rib design—function together to make Crane's new AWWA double-disc gate valves a wise choice for mains and distribution lines.

The double-disc assembly, held in close alignment by the new guide rib design, cannot jam or become disengaged in service. The trunnion-mounted discs are free to rotate as they are raised or lowered, preventing concentrated wear on both discs and seats. And, the rotary motion of the discs tends to clean the seating areas.

The new Crane double-disc gate valves meet all AWWA specifications—and more! For example, the 2-piece gland and gland flange with ball type joint is well-known for preventing stem binding even though uneven pull-up may be applied on gland bolts.

These quality AWWA valves are available in sizes from 2″ to 12″. Conforming to AWWA specifications, they are bronze-trimmed and have non-rising stems. For complete specifications, contact your local Crane Representative, or write to address below.

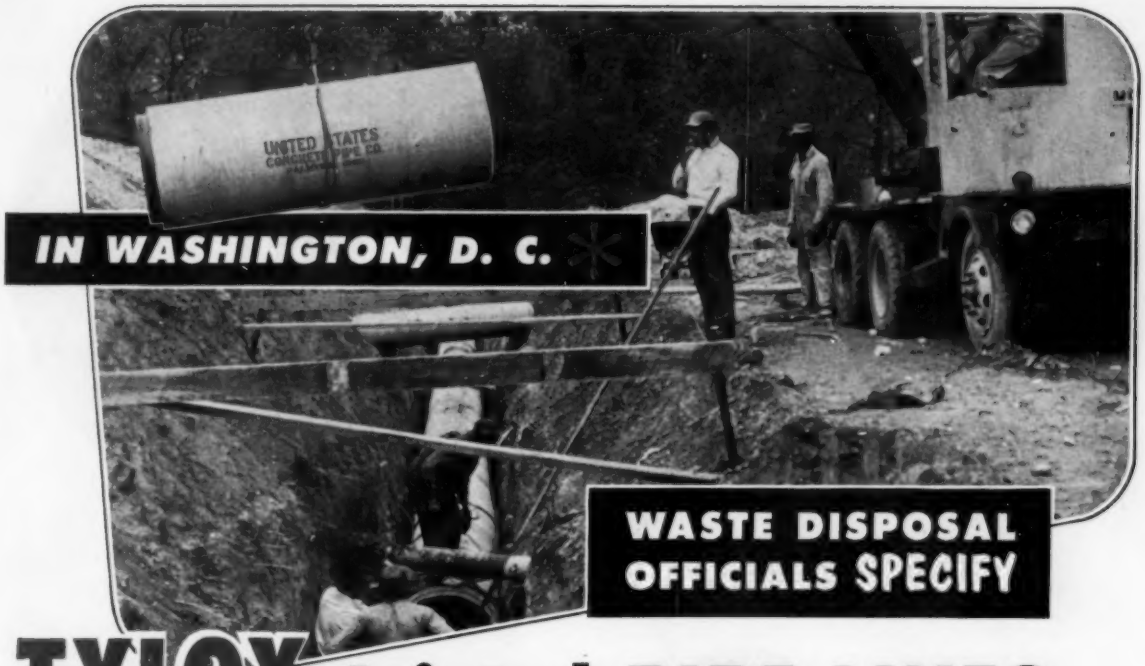


This view of the disc assembly shows simplicity of design that makes it foolproof in action. Entire assembly is suspended freely in valve body from stem, which engages upper spreader. Discs are suspended from upper spreader by trunnion principle.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas



TYLOX-Jointed PIPE LINES

TO REDUCE COST—LENGTHEN LIFE OF NEW SEWERS AND DRAINS

More and more city, state and Federal officials concerned with sewerage and drainage construction are specifying TYLOX Rubber Joints for the pipe lines they plan. Washington, D. C.'s new sewers at Kenilworth and Deane Avenues is only typical of this trend. When its designers called for this champion of all sewerage and drainage pipe-jointing materials, they gave the public "most for their waste disposal tax dollar" these three ways:

FASTER PIPE-LAYING—TYLOX-Jointed pipe goes together faster . . . eliminates "wet trench" delays and permits immediate back-filling. Reduces job costs by reducing man hours.

NO JOINT LEAKS—TYLOX Gaskets seal "rubber-tight" under compression. Water can't pass in or out of the pipe to cause pollution or bring on problems with roots or sediment. And naturally-resilient TYLOX **flexes** to protect joints from rupture due to surface loads or soil stresses.

NO CORROSION—Made of specially compounded rubber, TYLOX Joints are immune to sewerage or industrial waste acids and alkalies. TYLOX outlasts the pipe itself.

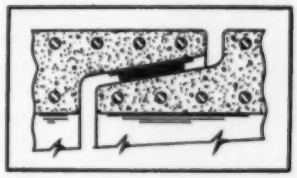
*

LOCATION: Kenilworth & Deane Avenues, Washington, D. C.

ENGINEERS: Sanitary Engineering Dept., Government of the District of Columbia.

CONTRACTOR: J. L. McIlvane Co., Washington, D. C.

PIPE: Vitrified Plate-Lined Concrete Pipe, manufactured by United States Concrete Pipe Company, Cleveland, Ohio.



This rubber-tight mechanical seal stays tight "for the life of the line."

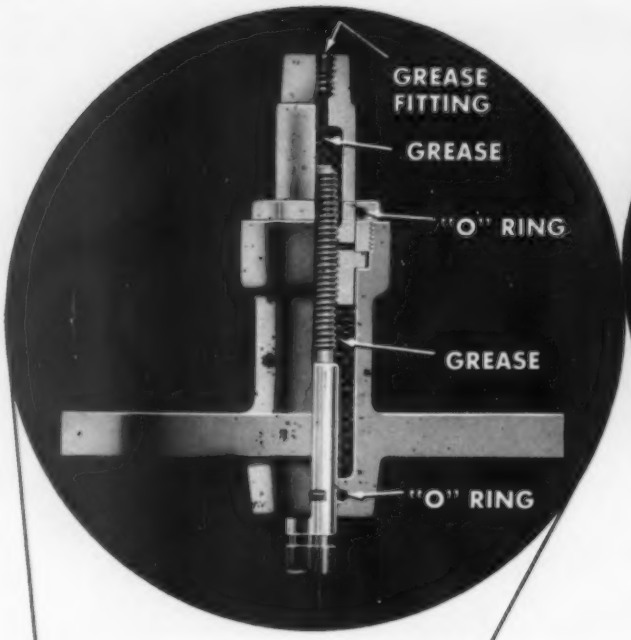
5008

Write today for more details and illustrated performance histories on TYLOX. Read the facts, and assure fast-working, leak-proof and non-deteriorating joints for your pipe jobs with a specification for TYLOX RUBBER JOINTS.

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

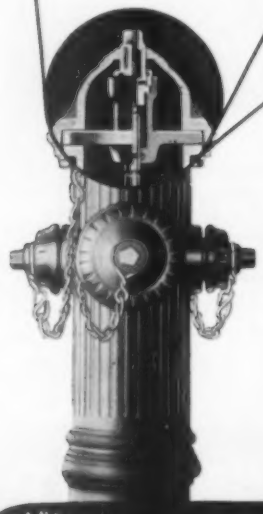
427 West Grant St. Orchard 3-9555



NEW DOUBLE FEATURE

SMITH HYDRANTS[48]

WITH "O" RING-SEAL AND GREASE CHAMBER FOR OPERATING THREADS



When you specify "O" Ring Seals rather than conventional packing you reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The initial compression of the "O" Rings provides the seal when the hydrant is closed. When subject to water pressure the lower "O" Ring is forced to the top of the groove. The sealing force increases as the pressure increases. The specially compounded rubber plastic "O" Rings insure a long life pressure seal. Each time the hydrant is operated, the "O" Ring Seals, the bearing surfaces, and the operating threads are automatically lubricated. Threads and upper section of the stem are continuously lubricated and sealed from contact with water in the standpipe. The lubricant is suitable for temperatures of minus 30 degrees to 200 degrees. All Smith Hydrants including hydrants in service can be fitted with "O" Ring Seal Plates.

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Huntsville, Alabama—

Rocket City, U. S. A.

recognizes 118-year service of

CAST IRON PIPE

Historic Huntsville, Alabama — rocket and guided missile development center of the U.S.A. — is one of the nation's 60 cities with Cast Iron water mains laid over a century ago. Completed in 1838, they are still giving dependable service.

Modern Huntsville is a thriving city with a "zooming future." Establishment of the Redstone Arsenal and location of many new enterprises have necessitated a major waterworks expansion.

Due recognition of the long and satisfactory service of Cast Iron Pipe in Huntsville was given by its City Council when it purchased 13,000 tons of new Cast Iron Pipe for this project.

Permanence, trouble-free service and savings to taxpayers are the major reasons why municipal engineers in the big majority of other cities also make Cast Iron Pipe first choice for new installations and extensions of existing systems.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Our Company does not manufacture Cast Iron Pipe, but produces quality iron from which quality pipe is made by many of the nation's leading foundries.

WOODWARD IRON COMPANY

Since 1882

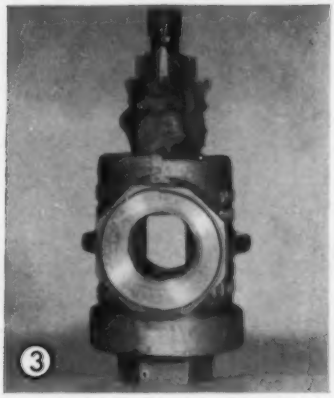
WOODWARD, ALABAMA

*SEE HOW *Controlled*
PRESSURIZED LUBRICATION
GUARANTEES LOWEST COST SERVICE FROM

HOMESTEAD *lubricated* PLUG VALVES

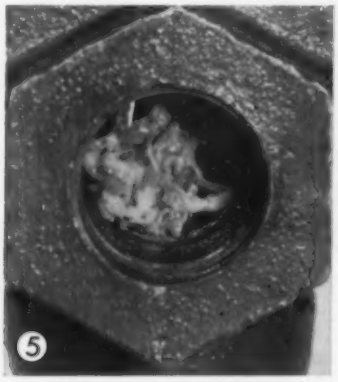
This plug was removed from a Homestead Valve just after starting lubrication, and before all sealing areas were filled with lubricant. Note that pressurized lubricant continues to extrude through feeder holes. Momentary downward movement of plug at start of each lubrication, gives assurance that plug is always free to turn.

The plug was again withdrawn from the valve body just after a ring of lubricant around the stem indicated that the lubricant system was full. Note that all lubricant grooves are filled. The entire plug surface is coated with lubricant. Lubricant is well packed in the stem sealing area above the plug.



Now valve has been purposely over-lubricated as indicated by excess lubricant around stem. Note that with *controlled* pressurized lubrication there is no extrusion or seepage of lubricant into valve port opening. This means no waste, no contamination of line fluids, no clogging of low pressure lines with lubricant, or fouling of meters, orifices, etc.

Also, in the Homestead Valve with *controlled* lubrication, you will note that even though the valve has been over-lubricated, lubricant comes only to the bottom edge of the plug, and is not wasted by discharging in quantity into the bottom chamber.



Now, see for yourself the risk involved when a valve which does *not* have Homestead's *controlled* Pressurized Lubrication, is over-lubricated. Note lubricant has been forced into the port opening. It can contaminate line fluids, foul meters or orifices, or even block low pressure lines!

* Unretouched photos.

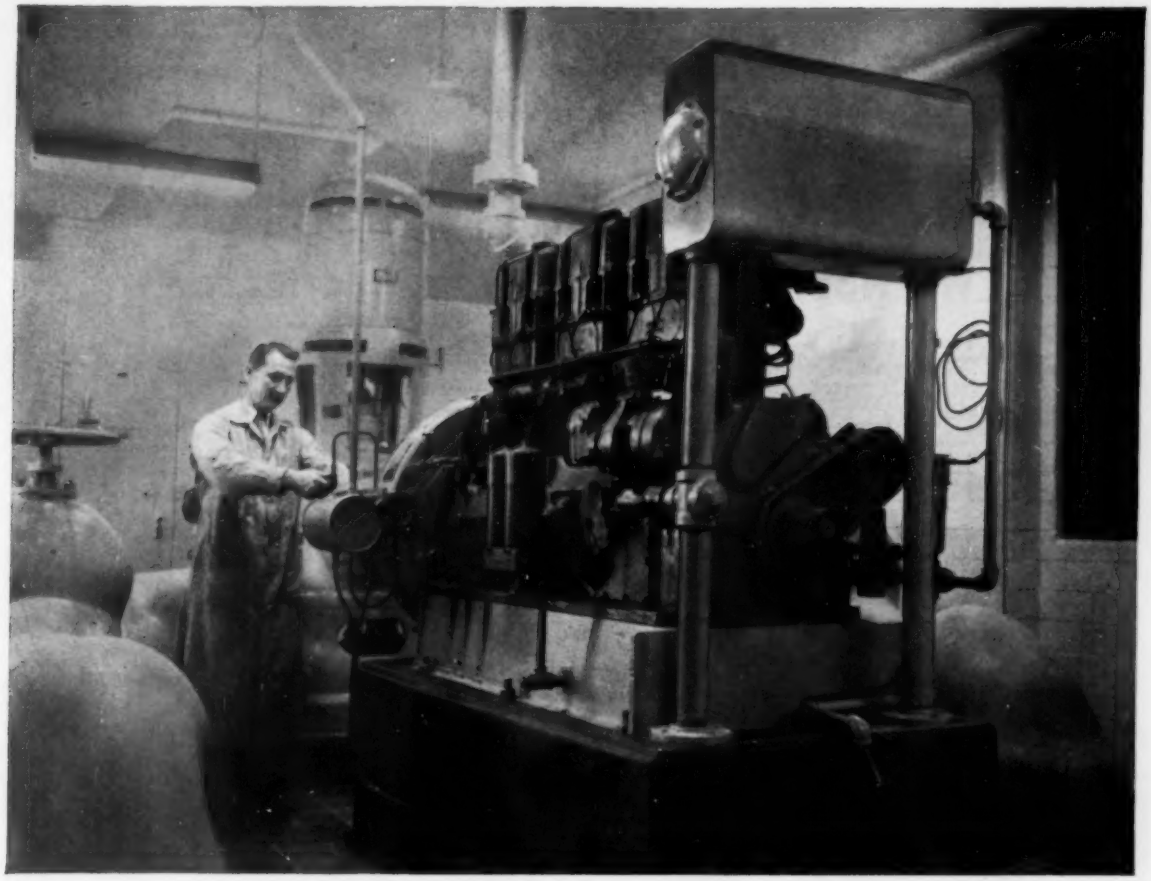
These are but a few of the many advantages of Homestead's controlled pressurized lubrication that guarantee lowest cost valve service.

Reference Book 39-5 has the full story—twenty-eight pages of engineering facts, sizes, types, dimensions, etc. Ask for your copy today. There is no obligation.

HOMESTEAD LUBRICATED PLUG VALVE (Pat. Pend.)

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 42 *"Serving Since 1892"* Coraopolis, Pa.



Standby...for Action

... the dependability built into Le Roi engines means that you have power when you need it most

The operator of the Le Roi F1500 shown above said, "This engine has surpassed our every requirement for standby power, and has more than paid for itself with dependable, economical, power production when we needed it most."

That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over $4000 a year for 14 years — others that have saved $7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 645 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

E-109

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS

TRACTAIR

STATIONARY AIR COMPRESSORS

AIR TOOLS

ENGINES

For Houston's new 50 mgd plant . . .

Freese, Nichols & Turner, Consulting Engineers, specified the most modern, master filter control system.

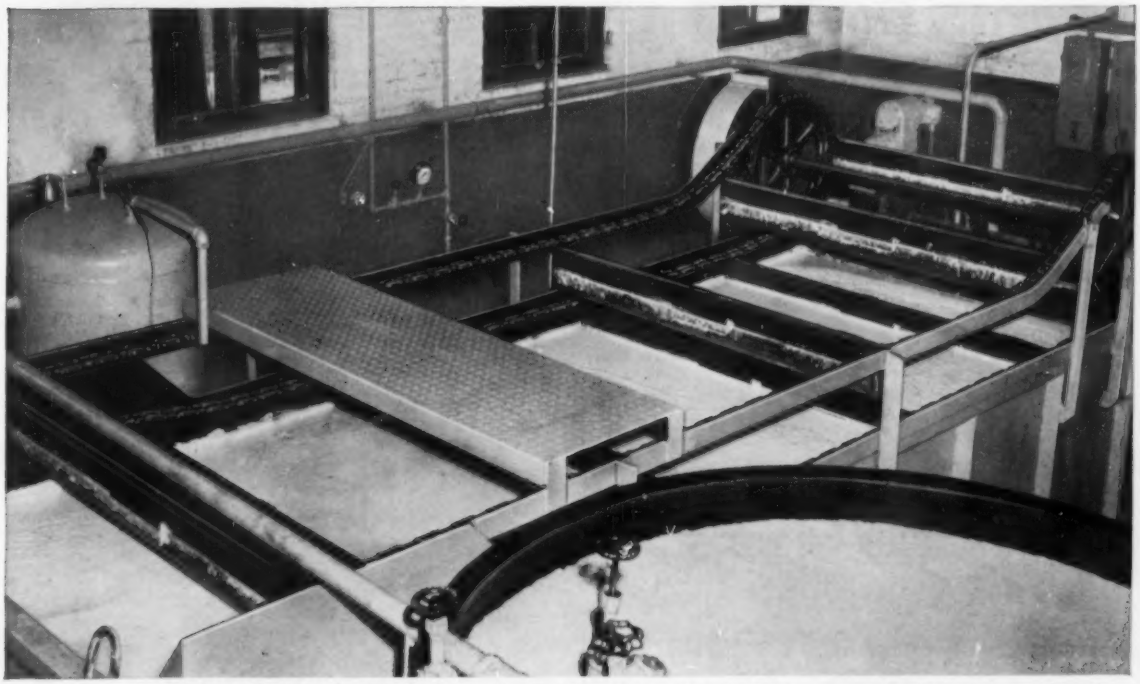
This system, for the City of Houston's recently completed $5,000,000 modern water purification plant that is now in service, must deliver top filter performance: maintain exact total flow despite changes in head in 8 filters; precisely measure flow rate, head loss; carefully control wash rates to protect beds; transmit all vital data to *one central control point*—with no lag, no hunting, no inaccuracies.

To meet these rigid requirements, Simplex flow controllers and instrumentation were selected. For dependable pipe-gallery operation, Simplex Laminair® units *pneumatically* transmit data to operating tables. For complete control of all the wide spread operating elements, Simplex Orthoflow® units *electrically* transmit data to one central point—instantly, accurately.

Your plant may achieve automated operation with minimum changes in present instruments and controls. Write for information. Simplex Valve & Meter Company, Dept. WS-10, 7 E. Orange Street, Lancaster, Pa.

SIMPLEX®
VALVE AND METER COMPANY

FLOTATION IS *ONE* EASY WAY...



A typical example of Rex Float-Treat's ability to handle industrial waste. Valuable fats are recovered in this large meat packing plant.

To recover materials – eliminate pollution – clarify water for re-use

For industrial waste treatment...in oil refineries, tanneries, meat packing and food processing plants, chemical plants and many other places, Rex Float-Treat offers a proven way of recovering oils, fats, grease and other materials, clarifies process water and liquids for re-use, and reduces pollution.

Rex Float-Treat eliminates the pumping of raw influent liquids so breakup of delicate, light solids ...the emulsification of valuable fats and oils... is avoided. Because only recycle is pumped, operating costs are substantially reduced.

Float-Treat is available as a completely packaged unit in a metal tank or can be furnished for concrete tank installation.

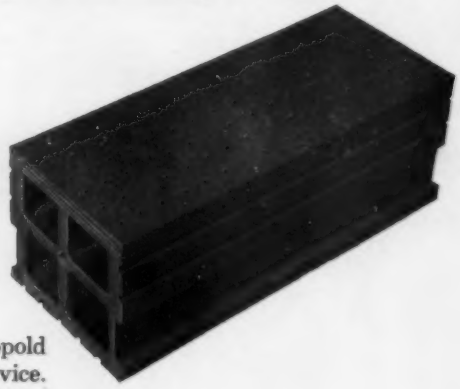
Rex Float-Treat is only one method of treating industrial and municipal wastes. Equipment is also available for screening, settling and grit removal. Get all the facts, today! Write CHAIN Belt Company, 4610 West Greenfield Avenue, Milwaukee 1, Wisconsin.

CHAIN BELT COMPANY
MILWAUKEE 1, WISCONSIN

A GOOD COMBINATION

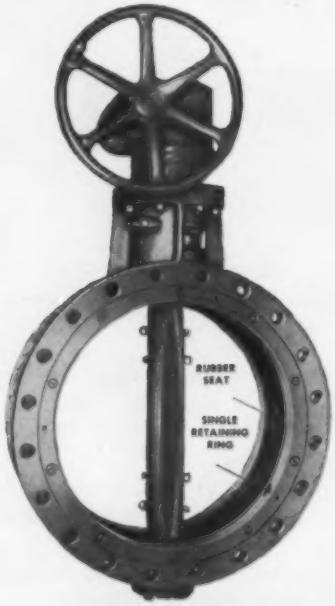
for better performance— lower operating costs...

LEOPOLD FILTER BOTTOMS



Designed to successfully meet all underdrain requirements

Made of de-aired fire clay—vitrified and salt glazed, the Leopold Filter Bottom is unequalled for dependable, economical service. The individual blocks resist corrosion, are not subject to tuberculation, and will last indefinitely. Too, they require only small sized gravel, do not need special supporting concrete members, and the Leopold design insures uniform wash distribution.



LEOPOLD
Rubber Seated
BUTTERFLY VALVES

Assure positive drop-tight shut-off easily, efficiently, economically.

In this design, the seat is of resilient Neoprene rubber or pure gum rubber, vulcanized around a steel ring insert, and held in place by a keeper ring. The steel ring, which is "continuous" to eliminate abnormal wearing, increases the firmness of the seat and assures longer service life.

Whether operated manually or by automatic controls, Leopold Butterfly Valves always provide a positive shut-off that's bubble-tight. Made in sizes 6" to 72".

Write today for descriptive literature!

Leopold

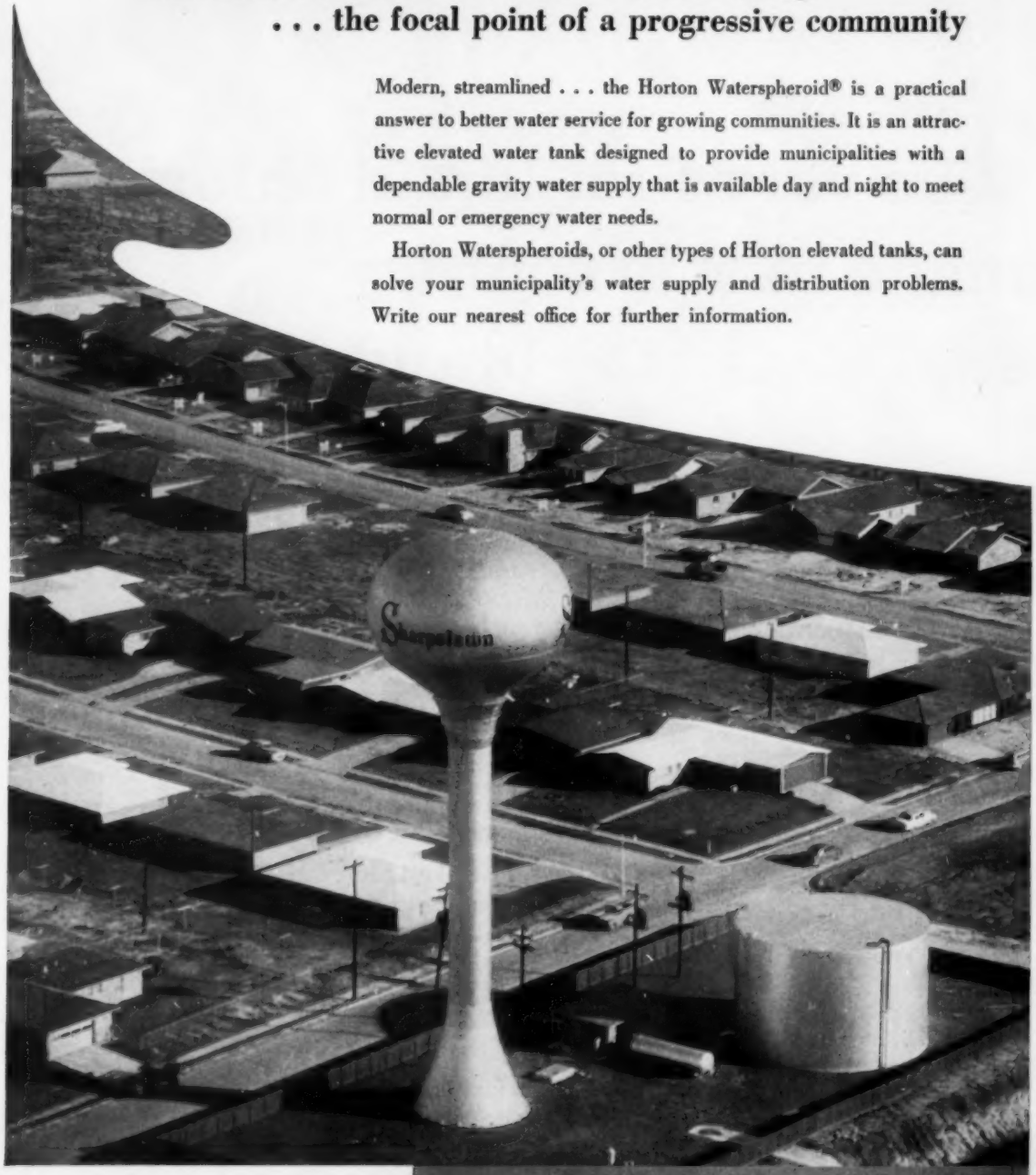
F. B. LEOPOLD CO., INC.
2413 W. CARSON STREET, PITTSBURGH 4, PA.

COMPLETE WATER PURIFICATION AND FILTER PLANT EQUIPMENT • BUTTERFLY VALVES
FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS

WATERSPHEROIDS . . . modern water storage
. . . the focal point of a progressive community

Modern, streamlined . . . the Horton Waterspheroid® is a practical answer to better water service for growing communities. It is an attractive elevated water tank designed to provide municipalities with a dependable gravity water supply that is available day and night to meet normal or emergency water needs.

Horton Waterspheroids, or other types of Horton elevated tanks, can solve your municipality's water supply and distribution problems. Write our nearest office for further information.



Above: 400,000-gal. Horton Waterspheroid built at the Sharpstown Development for the Harris County WCID #24, Houston, Texas.

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

The very first liquid chlorine made in this country sold under the brand name,

...and Nialk is still first in quality

In 100 and 150-pound cylinders, multiple unit tank cars of ton containers and single-unit tank cars of 16, 30, and 55-ton capacity.

A 100% pure product shipped in clean, well-conditioned containers with safe, tested smooth-functioning valves.

Your inquiry will receive our prompt attention.

HOOKER ELECTROCHEMICAL COMPANY
1710 Union Street, Niagara Falls, N. Y.

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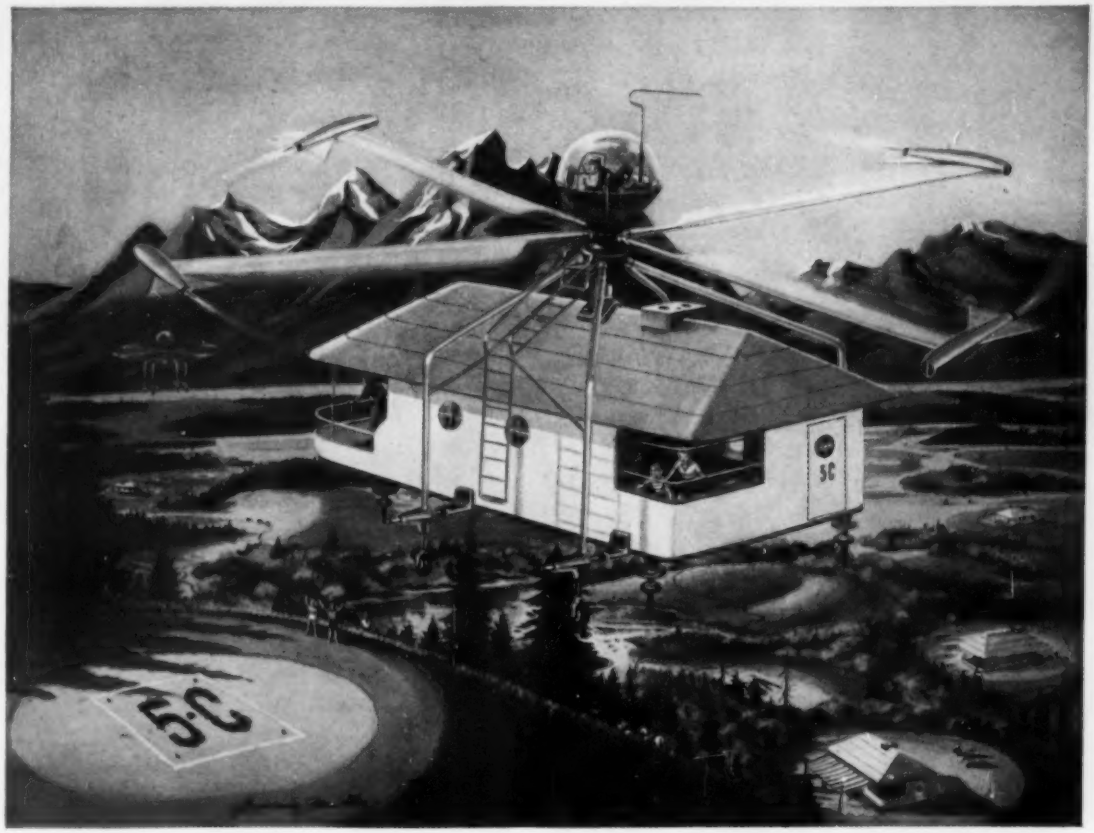
HOOKER CHEMICALS PLASTICS

6-1074



Giant helicopters . . . atomic-powered and capable of lifting vast tonnages . . . some day may transport homes intact from winter to summer locations . . . enable people to move with a minimum of disorder and effort.

100 years from now...

WE MAY MOVE HOUSES BY AIR!

Many incredible changes in the world of tomorrow. But even then, our water and gas will still be carried by that dependable public servant—the cast iron pipe being laid today.

Records show that cast iron mains installed over a hundred years ago are still serving effectively for more than seventy American water and gas utilities. Moreover, the modernized cast iron pipe of today . . . centrifugally cast and quality controlled . . . is even stronger, tougher, more serviceable.

U.S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S. cast iron PIPE

FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

CAST IRON

U. S. PIPE AND FOUNDRY COMPANY, General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE.

PENNSALT CHEMICALS for Water and Sewage Treatment

1 CHLORINE
A uniform quality water works grade of chlorine. Used by hundreds of cities and communities throughout the West because of confidence of PENNSALT'S Quality Control of the product. Shipped in 100 and 150 pound cylinders and one ton containers by rail, truck and water.

2 AMMONIA, Anhydrous
Water works grade, shipped in modern, lightweight cylinders which saves considerable freight cost and lightens the burden of handling. 50, 100, 150 pound cylinders.

3 PERCHLORON®
High-test calcium hypochlorite containing 70% available chlorine. Shipped in 100 pound drums; cases—9 5-pound cans to case.

4 CLOR®
A concentrated solution of sodium hypochlorite guaranteed 15% minimum available chlorine. Packaged in five gallon containers.

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20 PAGE BULLETIN OF HELPFUL PUMPING DATA, HYDRAULIC INFORMATION CONSTANTS AND DETERMINATIONS

Yes sir, you'll use this Bulletin every day. Printed in bold type, 8½" x 11" in size, with wide margins, it will bind right into a three-ring binder. In one convenient book you'll have the information you need to figure pump installation and operating data for both vertical and horizontal type pumps for industrial, engineered construction, commercial and domestic installations.

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WSW

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MODERNIZED **cast iron**

RAINFALL ...still not enough!

No secret to you that water is America's No. 1 Problem... that rainfall is largely wasted, unevenly distributed or polluted.

But does the public know it?

It's important that the great mass of the American people learn the facts. We're helping there.

Month after month our national advertising stresses the need for long range planning of water facilities; public support for realistic water rates; necessary water works financing; conservation by homeowner and industry.

Our aim... like yours... is to alert the public to the growing seriousness of water shortages... enlist their cooperation so that we—and our children—will be assured of a plentiful supply of water for all our needs.

CAST IRON PIPE

proved by Performance

Over a hundred years ago cast iron pipe mains were laid by more than 70 American utilities. They're still working efficiently.

Here's proof of cast iron pipe's dependability and longevity... its savings in maintenance costs and tax dollars.

Today's modernized cast iron pipe, centrifugally cast for greater strength and uniformity, is even more durable. Where needed, it can be cement-lined for sustained carrying capacity through generations of hard use.

When you specify pipe for your water system, remember: no other pipe can match cast iron's *proved* record of performance. It serves for centuries.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Illinois.

This rugged old cast iron water main, laid 125 years ago, is serving and saving tax dollars for the citizens of Detroit, Michigan.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe FOR MODERN WATER WORKS

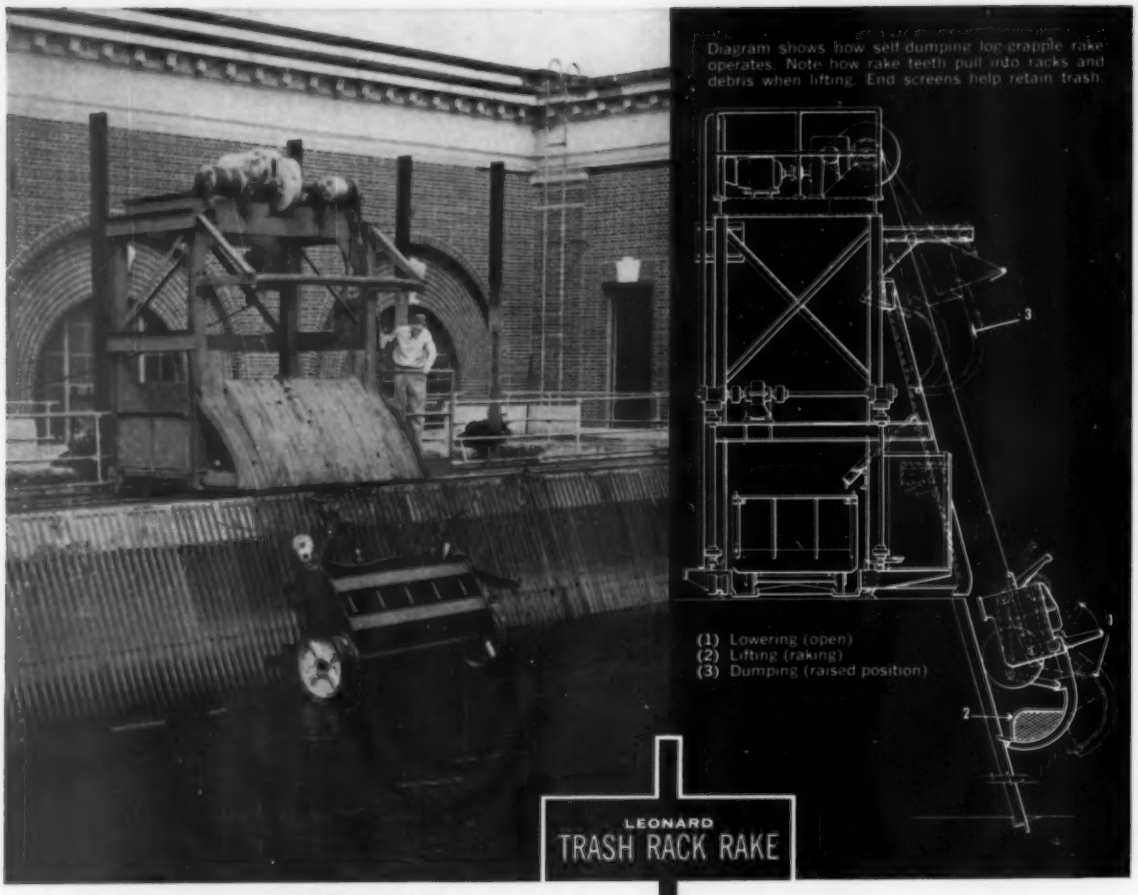


Diagram shows how self-dumping log-grapple rake operates. Note how rake teeth pull into racks and debris when lifting. End screens help retain trash.
(1) Lowering (open)
(2) Lifting (raking)
(3) Dumping (raised position)
1
2
3
LEONARD
TRASH RACK RAKE

New 8-foot, self-dumping SMS rake at Niagara Mohawk Power Corporation's Black River Station is one of five recently installed by this company.

Two New Self-Dumping SMS Trash Rake Designs CUT CLEANING TIME AND LABOR

Now SMS offers you two improved Leonard trash rack rakes, both regular and log-grapple types. These self-dumping rake designs make operation easier and quicker, permit you to clean a greater area faster. Both new rake types are now available as additions to the SMS line of standard rake designs.

SMS Leonard rakes operate directly on trash rack bars . . . ride down over stubborn obstructions and work them loose. Such freedom of movement assures fast, easy cleaning. Initial costs are low because the width of SMS rakes can be kept to the minimum required for handling for trash and the expense of guides attached to racks, or embedded in piers is eliminated. These rakes are of simple and rugged construction, designed for outdoor service and require minimum maintenance.

To get full information on Leonard trash rakes, or on other SMS accessories and hydraulic turbines, write to S. Morgan Smith Co., York, Penna. For Leonard rakes, request Bulletin 158.

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

HYDRAULIC TURBINES · GATES & HOISTS · TRASH RAKES · PUMPS · LIQUID HEATERS

HYDRODYNAMICS

MOTOR VALVES · FREE DISCHARGE VALVES · BALL VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS · BUTTERFLY VALVES

Licensees: The Harland Engineering Company, Ltd., Alloa, Scotland • Tokyo Shibaura Electric Co., Ltd., Japan

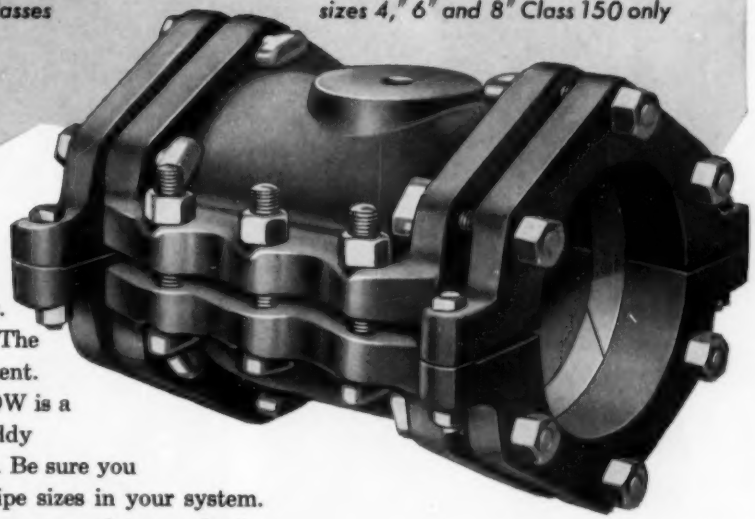
NOW from EDDY...

Mechanical Joint Split Sleeves

for repairing water mains...

CAST IRON MAINS
sizes 3" through 16" All Classes

ASBESTOS-CEMENT
sizes 4," 6" and 8" Class 150 only



Here's the fastest, most economical way to repair damaged water mains. Installation is a matter of minutes. The repair you make is positive, permanent. This is a reminder that RIGHT NOW is a good time to check your stock of Eddy mechanical joint split repair sleeves. Be sure you have some to match each of the pipe sizes in your system. Remember: Eddy repair sleeves come complete, ready for instant use, each with detailed instructions for installing . . . easily, quickly and with no tools other than a ratchet wrench. NOW is the time to order . . . or to mail the coupon if you'd like more information. No obligation, naturally.

Mail Coupon Now for full facts

EDDY VALVE COMPANY

WATERFORD, NEW YORK

Eddy Valve Company
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Please send me complete information on Eddy Mechanical Joint Split Sleeves.

(please check which)

For: ☐ Cast iron ☐ Asbestos-cement

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Address_____

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UP TO 72"

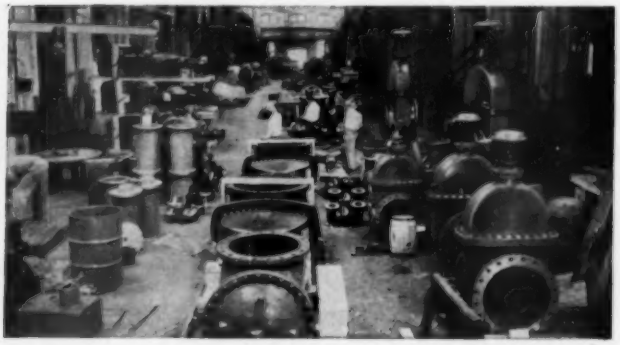
LUDLOW VALVES

The water supply for thousands of people may depend upon a few large valves which must be reliable. Only a huge, specially equipped foundry, backed by giant tools, in a modern precision machine shop can supply this dependability. Ludlow has been the headquarters for large valves for nearly a Century.

LONG LIFE and DEPENDABILITY are built in. Ludlow Valves are fully bronze mounted. The two piece wedging mechanism is simple and rugged. The double disc parallel seat construction results in a wiping action that cleans the seats during the closing operation. The stems are special high tensile strength Ludlow manganese bronze with precision cut modified acme threads.

"NO POSSIBLE DIFFERENCE IN FIRST COST CAN OVERBALANCE THE PERPETUAL ECONOMY OF QUALITY."

17

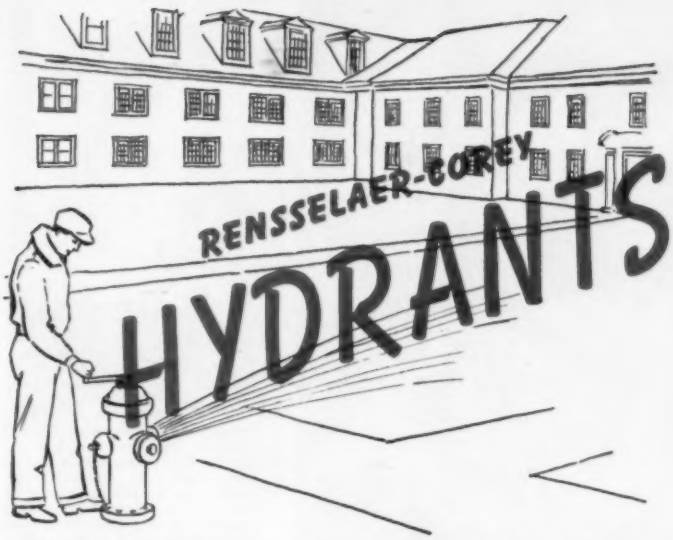


Ask for Bulletin 54W

THE LUDLOW VALVE MFG. CO., INC. TROY, N.Y.

TRADE LUDLOW MARK

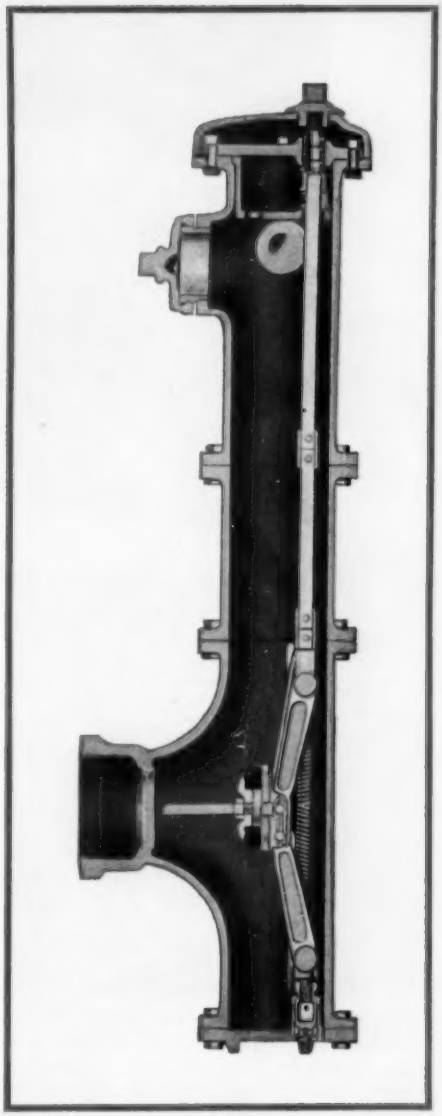
GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES
CHECK VALVES • TAPPING SLEEVES • AIR RELEASE VALVES

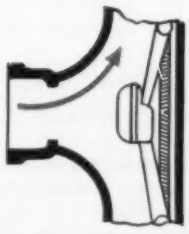


This is the hydrant that has been the standard of excellence in hundreds of cities for many years. Inspectors, maintenance men and fire chiefs, all have their reasons for endorsing the Rensselaer Corey Hydrant.

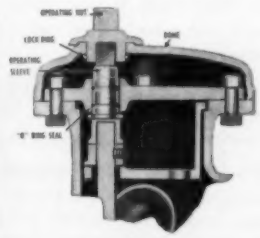
The illustrations show the clear-flow design which insures low head loss and maximum flow. Maintenance men like the simplicity of design and the speed of removing, inspecting and replacing the working parts as a single unit.

This hydrant opens with the pressure, is easy to operate and cannot stick. No digging for repairs, or for standpipe breakage. Now available with any type connection and "O" Ring seal.





CLEAR FLOW
LOW HEAD LOSS



HYDRANT HEAD
WITH "O" RING SEAL

Ask for Bulletin "G"

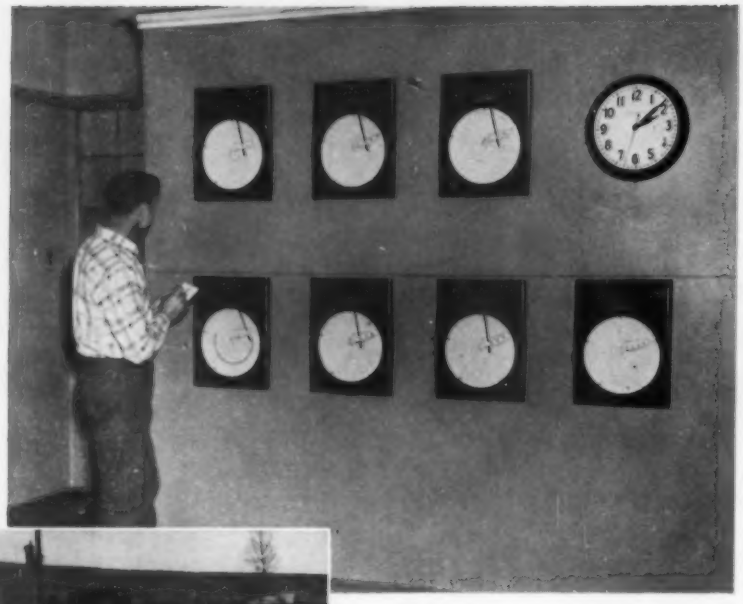
18

Rensselaer VALVE CO.

TROY, NEW YORK

DIVISION OF
THE LUDLOW VALVE
MANUFACTURING CO., INC.

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES
CHECK VALVES • TAPPING SLEEVES • AIR RELEASE VALVES



Brown indicating, recording, totalizing flow meters (top) for raw sewage and treated effluents, and (bottom) for air, return sludge flows and excess sludge. Raw incoming sewage is mixed with sponge-like, biologically-active sludge which absorbs pollution matter in the sewage. Sewage then flows to a clarifier, where sludge settles out, and clear, treated water overflows to the river. A portion of the settled sludge is reactivated in an aeration tank and is returned to the system to treat more sewage. Excess sludge is pumped to digesters.

Brown concentric-scale, indicating, float-actuated flow transmitter is used with a Parshall flume.

Brown Parshall flume indicators and air flow recorders are mounted outdoors near clarifiers and aeration tanks at the Biosorption sewage treatment plant in Austin, Texas.

Brown Instruments chosen for new, cost-cutting Biosorption Process at Austin, Texas plant

THIS SEWAGE PLANT at Austin used to be a standard activated sludge operation. By converting to the new Infilco Biosorption Process, the plant increased its capacity 167%, saved $200,000 in initial costs.

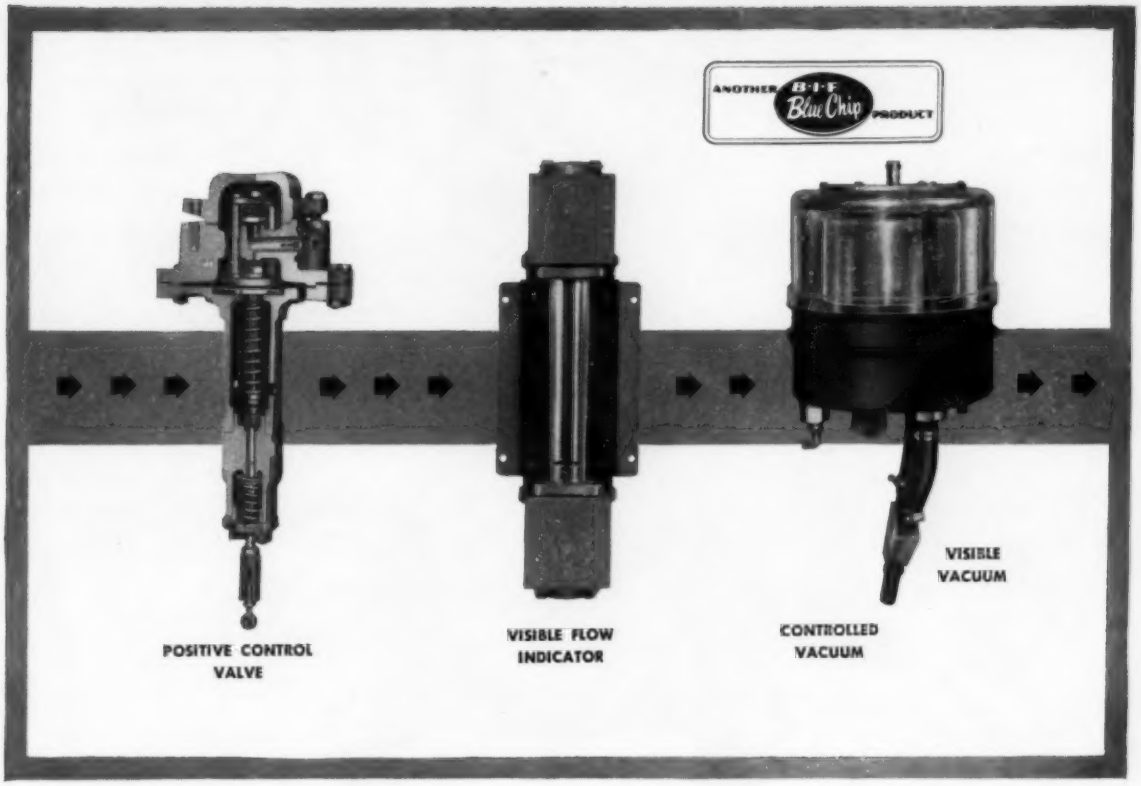
As in a growing number of sewage plant installations, Brown instruments provide operators with accurate working information . . . assure efficient, economical operation.

Brown flow meters indicate, record and totalize flow rates of raw sewage influent, clarified effluents, air, sludge returned to the system, and excess sludge. Orifice plates are used with air flows, Venturi tubes with return and excess sludge flows, and Parshall flumes are used with raw sewage and clarified effluents.

For your own water or sewage treatment processes, there are Brown instruments to cover practically every measurement and control requirement. For a discussion of your particular project, call your local Honeywell sales engineer. He'll welcome the opportunity to talk things over with you and your consulting engineer . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



IN CHLORINE GAS FEEDERS . . .

LOOK FOR KNOW-HOW

Here's proof of good chlorine feeder design! The gas flow path shown in this Builders-Providence flow-gram is the shortest offered by any manufacturer of chlorination equipment . . . and we invite comparison! Good design means maximum dependability (to the consulting engineer) . . . ease of installation (to the contractor) . . . and easy operation, low upkeep, and low operating cost (to the operator).

Our design offers all these and more. For added safety . . . there are no springs or piloted parts in contact with chlorine, no packed valve stems to leak and destroy feeding accuracy . . . and the simplicity of the entire system means better operation with less maintenance.

These superior features did not just happen — but are drawn from the vast reservoir of B-I-F application knowledge and experience gained as the major manufacturer of flow metering and control equipment for WATER, SEWAGE, and WASTE TREATMENT PLANTS. Many consulting engineers have profited by the valuable assistance received from B-I-F specialists. Our policy of continuing research and development has produced the most comprehensive, service-proven line available . . . and thousands of superior performance records reflect our broad design and manufacturing experience.

* * *

If you have a chlorine gas feeding problem, our engineers will gladly help you solve it. A call to GAspee 1-4302 in Providence . . . or to one of our local offices . . . will put us at your service. B-I-F Sales and Service Offices are located across the country for your convenience. Act today! Builders-Providence, Inc., 350 Harris Avenue, Providence 1, R. I.

B-I-F

B-I-F INDUSTRIES

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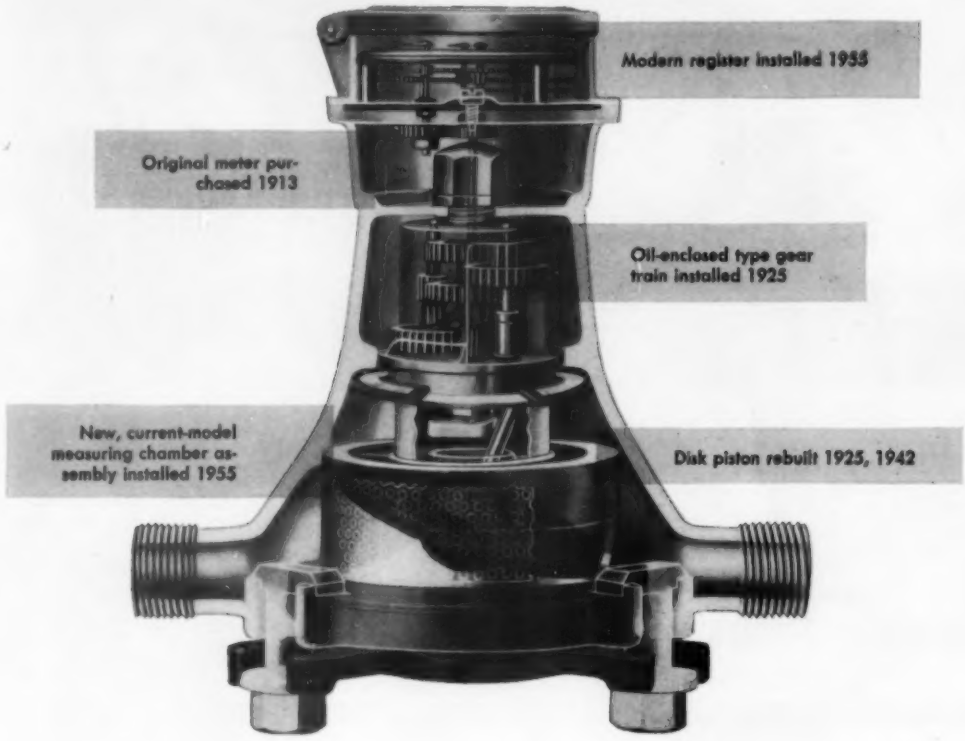
B-I-F METERS FEEDERS CONTROLS

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.


Modern register installed 1955
Original meter purchased 1913
Oil-enclosed type gear train installed 1925
New, current-model measuring chamber assembly installed 1955
Disk piston rebuilt 1925, 1942

How NEW is this Meter?

It was built in 1913 . . . but it's almost as new as 1956. Over the years, working parts have been replaced. Its performance matches every standard of modern metering practice.

The parts used to repair this meter at its last overhaul are identical to those used in the latest Trident meters. They embody every thoroughly tested advancement known to the science of metering.

Designing modern parts to fit "old" meters has been a rigid Neptune policy for over 50 years. It is just one of the extra advantages that make Tridents a better buy . . . both for today and for the years to come.

274

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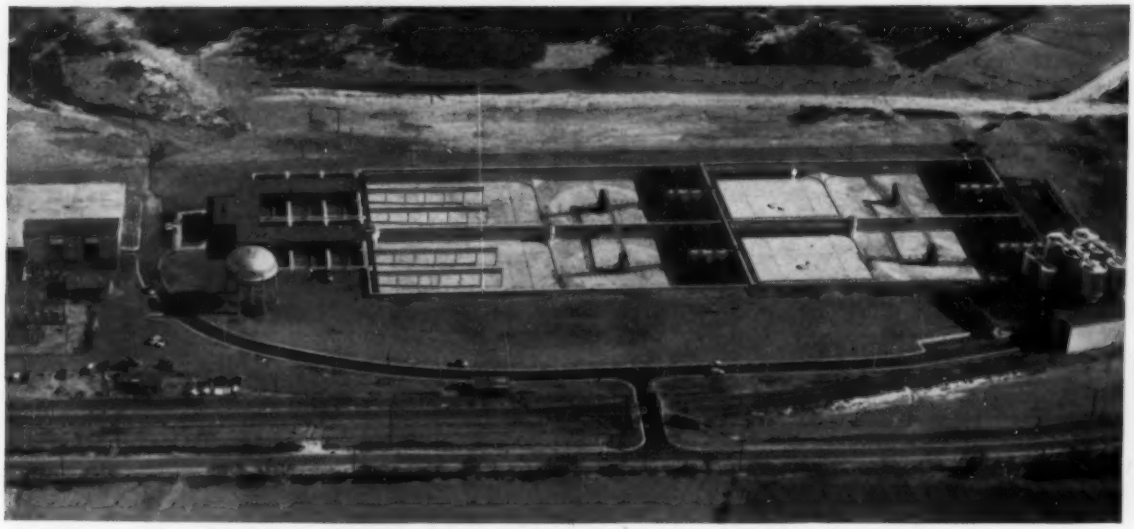
WATER & SEWAGE WORKS

VOL. 103, NO. 10 • A Scranton Gillette Publication • OCTOBER, 1956



NEW streamlined 48 mgd filtration plant of Corpus Christi, Texas

A New Water Plant For Corpus Christi

Features modern instrumentation, two-stage flocculation and clarification, flexibility and unique control applications

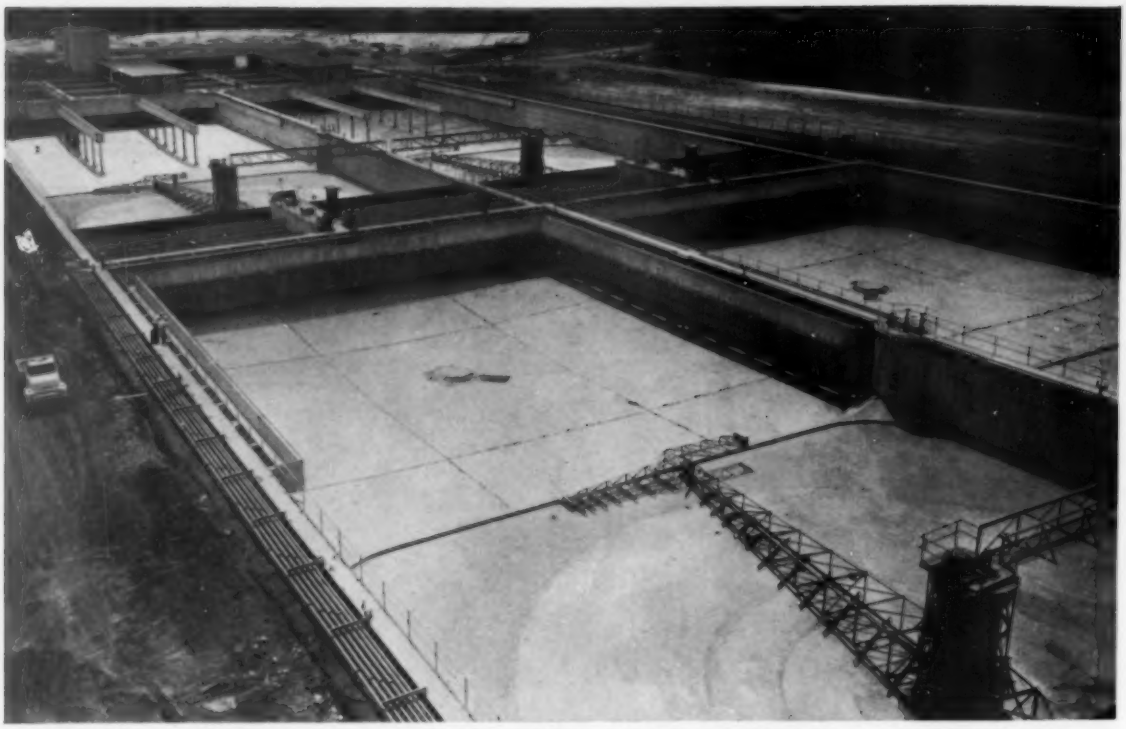
by E. N. NOYES

Mr. Noyes, consultant to Reagan & McCaughan Engineers of Corpus Christi, Texas, was responsible for the design and construction of Corpus Christi's new water plant. The new plant incorporates the most modern in the way of instrumentation and central station remote operation and control.

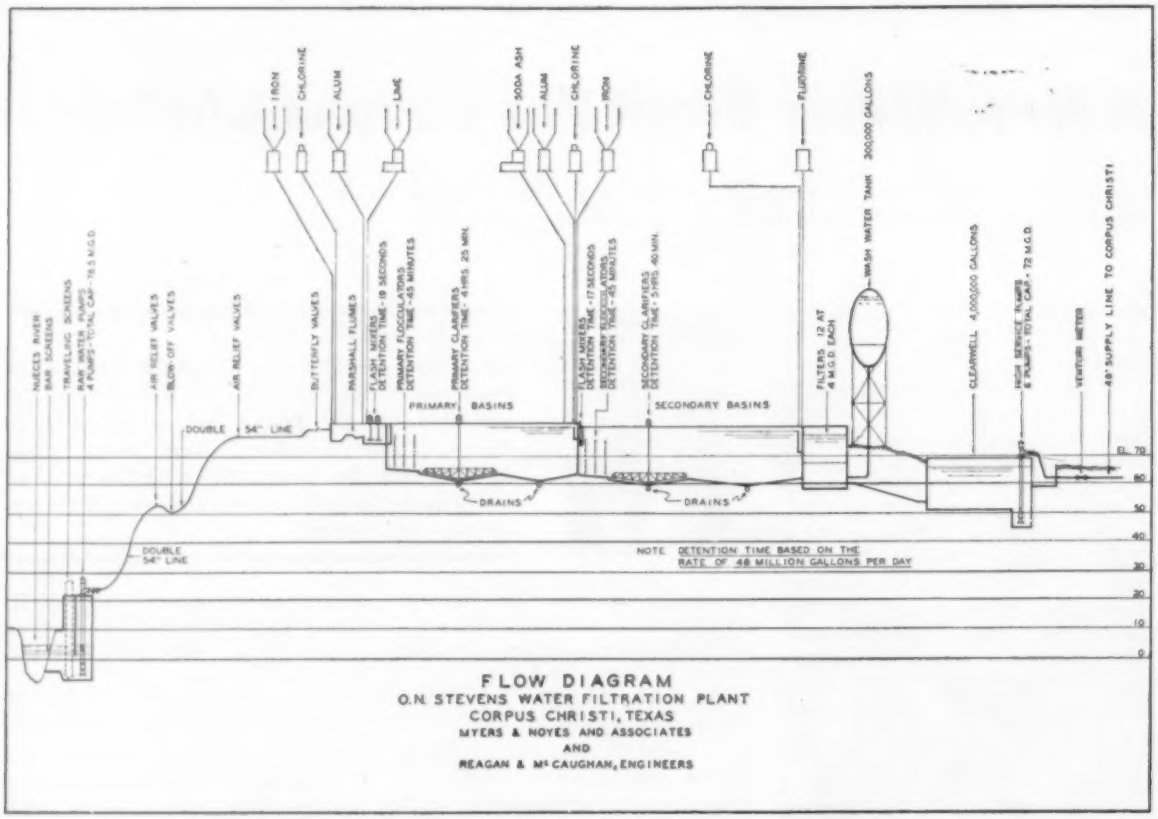
THE CITY OF CORPUS CHRISTI, Texas, is over 100 years old and its growth was slow until the 1920s. Since that time the growth has been described by the word "fabulous"; more than doubling in population in each decade, starting with a figure in 1920 of 10,000 and now an estimated 165,000 in 1956.

Maintaining an adequate water supply, treatment capacity, transmission and distribution systems has been, to all intents, the main problem of the City during the past 20 years. With the construction of a new dam well underway on the Nueces River to create a reservoir with an initial capacity of 300,000 acre feet, the completion of the new O. N. Stevens Water Plant, and the installation of transmission mains, 30 to 48 inches in diameter, along with accompanying distribution lines, the City can now apparently proceed with its water facilities at a slightly less than "emergency" rate of expansion.

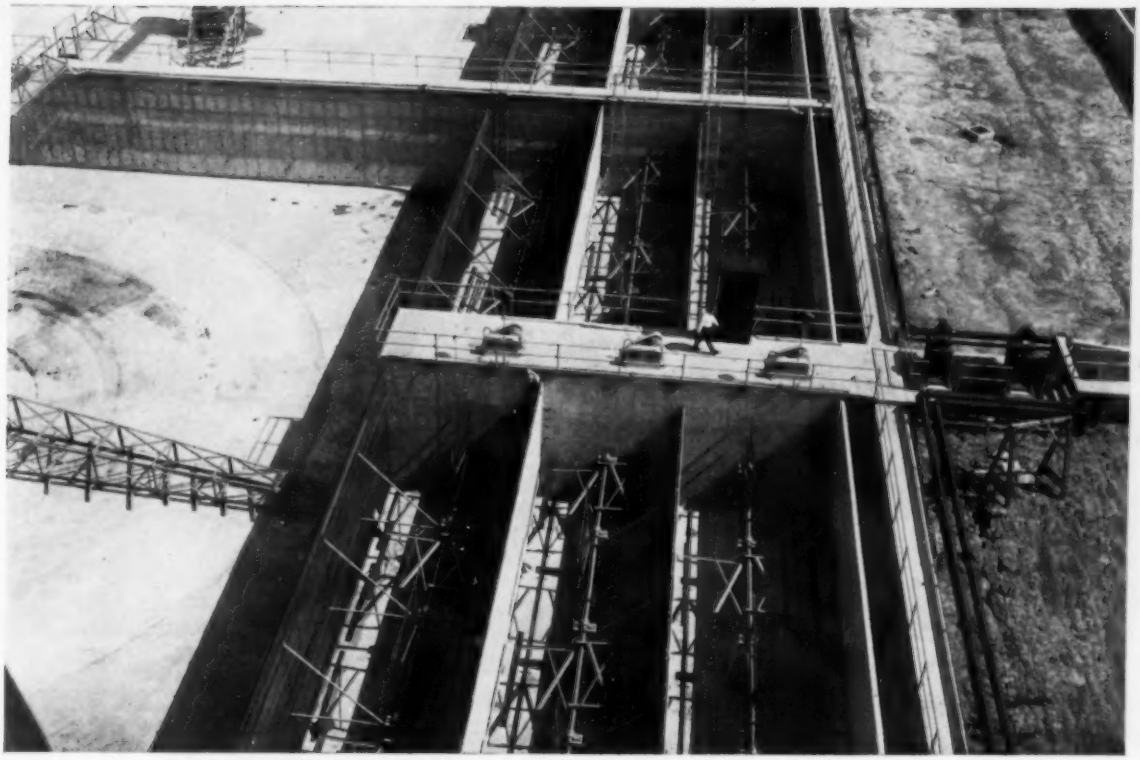
The first water plant for Corpus Christi was located on the Nueces River about 16 miles west of Corpus Christi, near the town of Calallen. This plant grew and expanded as the demand increased until it reached its present rated capacity of 33 MGD based on a filter rate of 2 gallons per square foot per minute. Of necessity, the plant has had to operate in recent years at rates of more than 50 MGD. Lack of available space at the site prevented further expansion, and a location for a new water plant was selected about a mile from the original.



PRIMARY and SECONDARY settling basins with intermediate flocculation chambers between and filters beyond.
(Note methods of effluent take-off from the two basins)



FLOW DIAGRAM and elevation sketch of the O. N. Stevens Filtration Plant.



FLASH mixing chambers and primary slow-mix flocculating units.

Determining factors in selection of the new site were: (1) elevation, (2) accessibility to highways and railroad, and (3) room for future expansion.

For identification, it was decided to name the two water plants. The original plant was named the "John W. Cunningham Water Plant" in honor of the Water Superintendent who has been with the City for the past 40 years. The new plant was named the "O. N. Stevens Water Plant" in honor of one of the prominent citizens of Corpus Christi who was the first plant manager of the first large industrial plant to be located in this area and who, since his retirement, has devoted much of his time to obtaining a more adequate water supply for the City.

Construction on the O. N. Stevens Water Plant was started in May of 1954 and was officially accepted on May 16, 1956, after a test period of several months.

This new plant has a rated capacity of 48 MGD with provision for expansion of 144 MGD. All piping, flumes, gates, filters, chemical feed machines, etc. are designed for 72 MGD for the first units. Flow through the plant is by gravity throughout except for the initial pumping of the raw water from the river.

The plant comprises the following principal units:

River intake and raw water pumping station;
Twin conduits from the river to the plant site;
Parshall flumes;
Primary and secondary mixing; flocculating and settling basins;
Chemical house;
Filter building with 12 filters;
Wash water tank;
Clear well;
High service pumping station;
Railroad service track;
Sludge drain lines and disposal area.

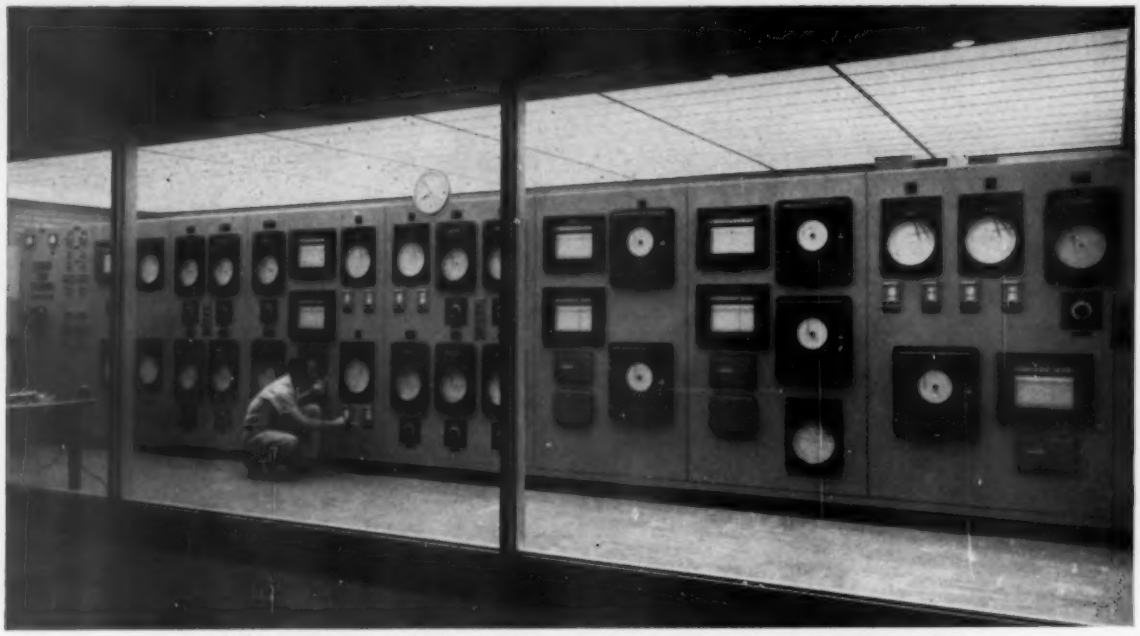
From the plant a 48-inch water line 15 miles in length transmits the water to the distribution system.

Raw Water Pumps

The raw water intake and pumping station is located on the Nueces River approximately ¾-mile upstream from the John W. Cunningham Water Plant and 1 mile northwest of the O. N. Stevens Plant. The intake consists of removable bar screens and two traveling water screens with concrete conduits opening into two pump pits. The bottom of the conduits is 7 feet below water level in the river.

The pump station includes 4 vertical, mixed flow turbine type pumps driven by 4160 volt motors. The total pumping capacity is 78 MGD against an 80 foot head. The pump room floor is 7.5 feet above the highest known flood level and since the flood plain is very wide, this is considered ample protection from any future flood.

This pump station is about a mile from the treatment plant and is to be unattended except for periodical maintenance and inspection. Pumps are normally controlled from the Chemical Building. A supervisory control system was installed between the Pump Station and the Chemical Building. This system uses a two wire communication type circuit between the two points and has an assembly of electric relays, instruments, control push buttons and other related devices at each end. The system provides in the Chemical Building the following operations of the raw water pump station: "start-stop" control, "running-off" indication, starter



CHEMICAL CONTROL panel with river pump station supervisory control panel on far left.

trip alarm and indication, and telemetering of motor current for the four pumps; remote indication and alarms for seven other functions; and incoming voltage telemetering. A safety switch for each motor control can eliminate the supervisory system at times when it is desired to manually operate the pumps at the pump station.

The raw water is pumped thru twin conduits from the river to the plant site. These conduits, for the most part, are 54 inch concrete pressure pipe; however, for flexibility and future modification, each end was reduced to 48" cast iron pipe. At the treatment plant end just before discharging into a concrete flume are 48 inch butterfly valves, one in each conduit, for accurately controlling the flow.

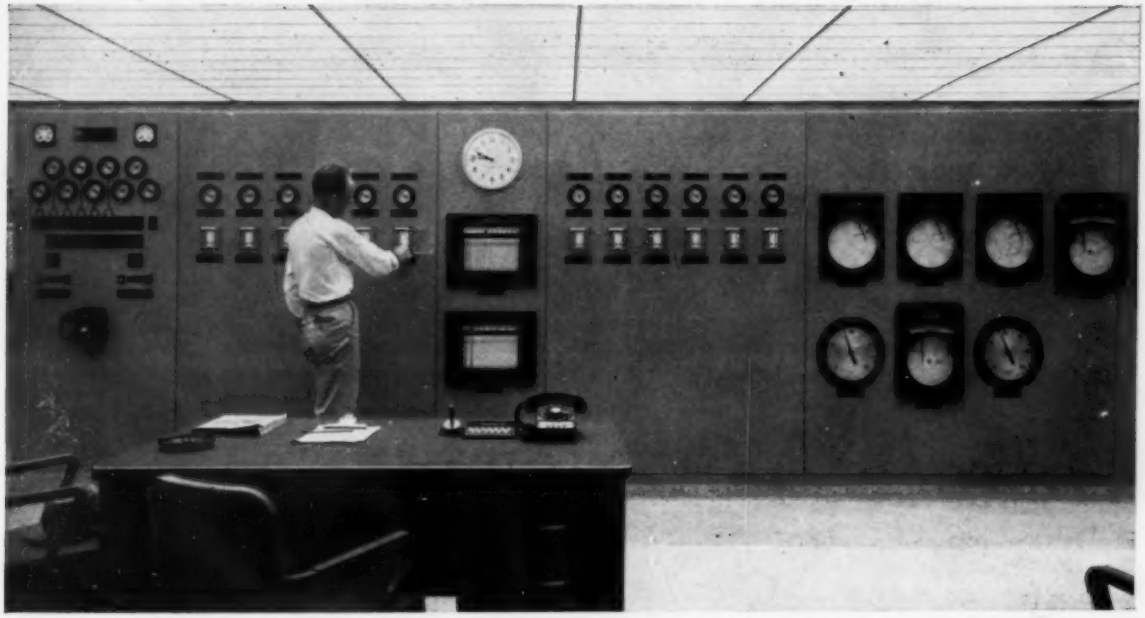
Mixing And Settling Basins

There are two twin lines of mixing and settling basins, each line consisting of primary and intermediate mixing and flocculating basins, and primary and secondary settling basins. Each line of basins is provided with independent entrance gates so that either line may be taken out of service, drained and cleaned. Flows thru each line are measured by Parshall Flumes and indicated and recorded on the control panel in the Chemical Building by use of pneumatic transmitters.

Rapid mixing and slow flocculation for both primary and secondary basins consists of flash mixers followed by three rows of cross flow, paddle type slow mixers with variable speed drives.

The front ends of both the primary and secondary clarification basins are provided with sludge collectors which sweep the settled sludge to a central sump. Provisions are made for installation of collectors in the second half of the primary basins should they be required in the future. Sludge may be withdrawn continuously or periodically, as desired, by use of gate valves and piping which discharges the sludge into an open pit where visual inspection can be made.

PIPE GALLERY of South filters: 42" wash line and pneumatically controlled butterfly valve rate controllers and air-motor operated plug valve.



FILTER CONTROL panel with high-service pump supervisory control panel, with phone, on left.

Chemical House

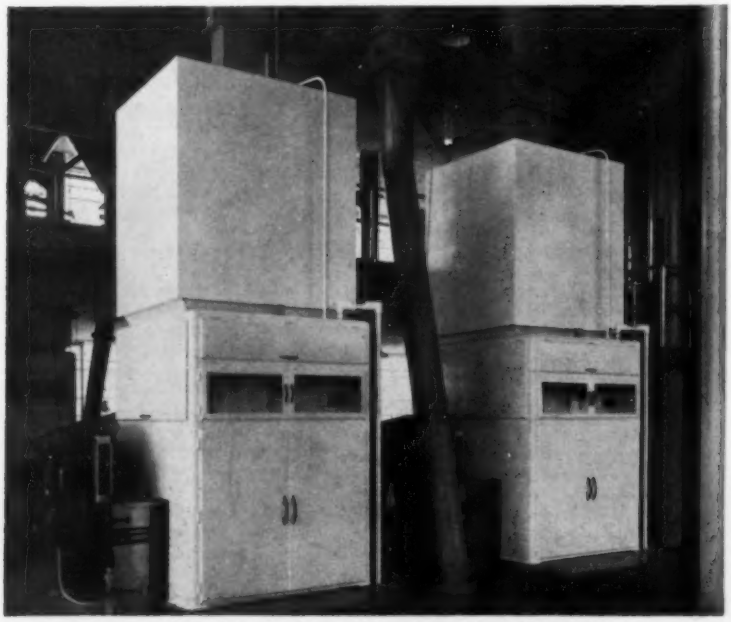
The Chemical Building which serves as one of the central operating and control stations is equipped for handling, storing and feeding of aluminum sulfate, quicklime, ferrous sulfate, soda ash, fluorides and chlorine.

Lime, alum, and iron will generally be received in bulk either in hopper bottom cars or in trucks, and these chemicals are elevated and stored in large circular steel bins above the Chemical Building—(see cover picture). Special provisions are made for storing soda ash and fluorides in bags or drums.

As a dust preventive the handling of bulk chemicals is by screw conveyors and bucket elevators of the enclosed type. To prevent the mixing of quicklime with other chemicals, one conveyor system is used for the lime and a separate one for alum and iron. The conveyor systems are so arranged that chemicals may be transferred from one storage bin to another.

Chemical feed machines, loss-in-weight type, are located under the steel storage bins so that the chemicals will feed directly into the feed machine hoppers. The rate of feed of each machine may be controlled either at the central control panel or at the machine.

Chlorine is received in one ton containers with storage space for 22 containers, 11 in use and 11 in reserve. Provision is also made for future use of chlorine in single unit tank cars.



TWO of the loss-in-weight type chemical feeders.

Unique Chlorine Flow Control

A unique system is used in the control of the flow of chlorine. The system was designed by Mr. Atlee Cunningham, City Water Superintendent, and has been used to advantage in the John W. Cunningham Plant for several years. The chlorine gas pressure is reduced with exactness to 5 psi and accurately controlled by means of a flow diaphragm motor valve. The flow is then measured by the pressure drop thru an orifice. The maximum differential is set at 21 inches of water at the maximum machine capacity with the differential transmitted by a differential converter transmitter to a local mounted

HIGH SERVICE pumping Station; six vertical turbine pumps (2-11,000 gpm: 4-7000 gpm) against 230' head.

stack controller and an air motor flow control valve. There are five units installed, three of eight thousand pounds per day capacity and two of two thousand pounds per day capacity. Remote control, indication, recording and integrating, is maintained at the control panel. Dry chlorine gas is piped from the machines where it is mixed with the water just ahead of the point of application. Adequate safeguards are provided at the points of application to prevent water being drawn back into the chlorine gas system.

A small routine testing laboratory is located in the Chemical Building. A well equipped laboratory in the John W. Cunningham Water Plant is used for complete analysis and bacteriological testing.

Instrument and Control Station

The instrument and control station arrangement of the panel in the Chemical Building permits the operator to follow the treatment process throughout by means of 57 operational information and control stations. Included are pressure in raw water pipes; temperature recording of raw water, turbidity and flow thru each line of basins; three two-point turbidity and three two-point pH recordings at ends of primary and secondary settling basins and at the end of the secondary flocculating basins; recorder-totalizer and rate settling stations for each of 12 chemical feed machines; recorder totalizer and indicating tel-o-set stations for five chlorine feed machines for primary and secondary chlorination; recorders for chlorine residuals; water level recorders for secondary settling basins; and pH recorder for final plant effluent. Annunciators and alarms are installed to signal malfunction or need for inspection of chemical feed machines.

The Filters

There are 12 rapid sand filters arranged in 4 rows of 3 filters each with 2 pipe galleries. Nominal capacity of each filter is 4 MGD with a maximum capacity for short periods of 8 MGD. All piping, conduits, gates, controllers, etc. are of ample capacity to carry the maximum rates without excessive head losses. Filters are not enclosed due to the improbability of freezing in the mild temperature of this area; however, operating galleries are enclosed. The filters are of the conventional sand and gravel type with cast iron underdrains.

Settled water enters the filters and waste wash water leaves the filters thru concrete conduits on opposite sides of the filters from the pipe gallery, thus eliminating the need of large pipe and valves in the pipe gallery for either settled water or waste wash water.

Another unique feature of this plant is the method of controlling the rate of flow through the filters. The rate of flow for each filter is controlled by a pneumatic system similar to that used for chlorine flow control. The control system automatically actuates diaphragm motor operated butterfly valves. Flow tubes are used as a primary device for measuring water from each filter. Each "Tel-o-set" pneumatic control system mounted on the Filter Building Control panel also provides remote manual operation at the panel when desired. Changing from automatic to manual control can be accomplished without interferring with the process operation.

The Filter Building control panel provides operational information and control stations for the twelve filters. Loss of head through each filter

FIVE pneumatically controlled chlorinating units (Original design by Atlee W. Cunningham, Genl. Supt. of Water Works)

is indicated at the individual stations and recorded on a single 12-point strip chart recorder. "Tel-o-set" control stations indicate and control the rate of flow for each filter, all recorded on another twelve-point recorder. Mounted on the panel is a liquid level recorder for the clearwell and another for the wash tank; a wash water totalizer-indicator; plant discharge flow recorder-totalizer, indicator; plant discharge pressure recorder; and discharge pressure indicator.

The wash water rate of flow is indicated on large double-faced indicators, one located in each filter gallery.

Filter operating tables are equipped with duplex dial gauge indicating the rate-of-flow and loss-of-head for each filter. These dials operate in conjunction with the instruments on the panel.

High Service and Wash Water Pumps

A 4,000,000 gallon capacity concrete ground storage reservoir is provided as a cushion between the filters and the high service and wash water pumps. These pumps are all of the vertical mixed flow type and are mounted in a building on the roof of the clear well. These pumps are powered with vertical solid shaft, 4160 volt motors. Total capacity of the six high service pumps at a rated head of 230 feet is 72 MGD and the total capacity of the two wash water pumps is 36 MGD. Control of all of these pumps is centralized in the Filter Building on a supervisory panel adjacent to the Filter Control panel. The supervisory system is similar to that used for the raw water pumps except that the high service pumps start and stop against a closed valve. The valves are motor operated plug valves and may be opened, closed or set at any desired position from the Filter Control panel. Gages for indicating each pump discharge pressure as well as a main line gage are located on the supervisory panel so that the operator may adjust the valve opening to any desired position.

Summary

In the design of the plant emphasis was placed on efficiency of operation with centralized and automatic control to reduce the work load of the operators and to insure a water of satisfactory quality. Automatic controls are electrically or pneumatically operated as was found most desirable in each case.

Particular attention was given to ease of access to equipment and piping. The pipe gallery in the Filter Building has ample headroom for maintenance and handling pipe and valves. Spacing of equipment in the Chemical Building provides for easy access to the conveyor system and chemical feed machines. The instrument and control panels have open areas in the rear so that instruments, wiring and pneumatic piping can be easily reached.

In the high service pump room the pumps are so spaced that they may be readily reached with the overhead crane for all maintenance purposes.

The Chemical Building and the Filter Building are each equipped

with convenient shower and locker rooms and a modern machine shop for making routine repairs is located in the Chemical Building.

Buildings are finished in buff brick with glass, marble and slate trim. Floors are generally of concrete, however, terrazzo was used in the filter operating galleries.

Design and Construction

Engineering and design were by Reagan & McCaughan, Consulting Engineers.

Architects were Whitney & Tomlinson.

Electrical Design was by Thomas E. Duce Associates.

All of the above are of Corpus Christi, Texas.

Portion of Work	Contractor	Contract Price
General Plant	C. H. Leavell & Coastal Bend Const. Co.	$3,868,356.18
Raw Water & Drain Lines	Heldenfels Brothers	347,385.96
Railroad Spur	J. M. Dellinger, Inc.	36,565.48
Wash Water Tank	Chicago Bridge & Iron Co.	52,345.73

Equipment, Materials and Suppliers

Electrical Switch Gear	Westinghouse	Flash Mixing Equipment	Link-Belt Co.
Pumps—High Service	Byron Jackson	Chemical Conveyors & Elevators	Link-Belt Co.
Pumps—Raw Service	Byron Jackson	Chemical Feed Machines	Omega Machine Co.
Pumps—Wash Water	Wintroath	Chlorine Flow Controllers	Minn. Honeywell-Brown Inst. Div.
Pump Motors—High Service	General Electric	Chlorine Evaporators	Wallace & Tiernan
Pump Motors—Raw Service	General Electric	Chemical Instrument Panel	Minn. Honeywell-Brown Inst. Div.
Pump Motors—Wash Water	Electrical Machinery	Supervisory Controls	Westinghouse
Plug Valves	Nordstrom Valve Co.	Filter Rate of Flow Controls	Minn. Honeywell-Brown Inst. Div.
Pipe—Cast Iron	American Cast Iron Pipe Co.	Traveling Water Screens	Chain Belt Co
Pipe—Concrete	Gifford-Hill-American	Filter and High Service Control Panel	Minn. Honeywell-Brown Inst. Div.
Flocculators	Link-Belt Co.	Wash Water Tank	Chicago Bridge & Iron Co.
Clarifiers	Link-Belt Co.	Venturi Meters	Builders-Providence

Indianapolis Water's "J.E.K." Named Ass't. to the Exec. V.P.

Executive Vice Pres. Dan P. Morse of the Indianapolis Water Co. has announced the promotion of John E. Kleinhenz, Mgr. of Publicity & Advertising to the position of Ass't. to the Exec. Vice Pres.

John Kleinhenz took a liking to the water works business, joined the Indianapolis Water Co. in 1925 as "Ass't. to the Chief Hydrant Painter", where he soon learned that yellow was the preferred color, that green would be tolerated, but red—*never*.

John was advanced to Chief Clerk of the Distribution Division. In this position he conceived and introduced the little house-organ "Water Lines". In 1939 he was placed in charge of Publicity & Advertising, which he will continue to supervise while serving as buffer to the Exec. "Veep".

White House Now Metered

The White House is now equipped with water meters to comply with a law passed by the 83rd Congress, requiring that government buildings be metered and pay the District of Columbia for all water used on a measured basis. Incidentally the White House uses water at the average rate of 110,000 gallons daily.

Make a "Scraping-Mitt" From Ordinary Window Screen*

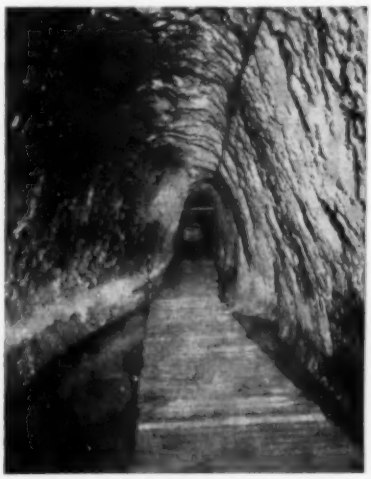
If you have some old scraps of window screen lying around you can utilize them for scraping soot, scale, rust, dirt, and the like from surfaces on which such matter has attached itself.

Every reader is doubtless familiar with steel wool and its use for scraping and cleaning. The old window screening can be made to serve the same purpose. One way, if the sheets of screen are large enough, is to make a "mitt" into which your hand is thrust, and you can then "go after" the adhering matter with telling effect. You may not like to get your hand dirty, but you can do a better job in that way because you can "feel" the surface with your fingers through the wire screen and even through a cotton glove that can be worn inside the wire "mitt", if desired. For places that cannot be reached by hand, tack some window screening on the end of a stick and use that as a scraper.

*Contributed by W. F. Schaphorst, M. E., Newark, N. J.

Hebrew Water Engineering

Away back in biblical times the ancient city of Megiddo had no water supply within its walls; and, being subject to siege by many armies, a supply was sought without the walls. A spring was located 150 feet from the wall in the rock and a well was



sunk and a sizeable vein was found. A shaft was then sunk inside the walled town and a tunnel was commenced from the well outside and from the shaft within. Proceeding from both ends the tunnelers met in the center, an astonishing feat in the days of scriptural history. How well the tunnelers met can be seen in the accompanying photograph.—C. J. Robb, Ballynahinch, Ireland.

Penna. Water Works Operators Assn.

Holds 29th year meeting at Penna. State University

THE 1956 Conference of the Penna. Water Works Operators Assn. was held at the Penna. State University Park, Penna. Although Penn State has changed from a College to a University, and the post office of the University has been renamed, most water works men will think of this as the annual State College meeting of the Pa. WWOA.

True to custom, more than 325 persons attended, including about 70 wives. In addition to the usual technical fare, there was a social hour at the new Hetzel Union Building and a chicken barbecue at nearby Lions Park. Both were delightful, except for the mosquitoes at the barbecue.

Ret. Pres.
S. P. McBride

President
J. O. Fulmer

1st Vice Pres.
L. S. Duckworth

2nd Vice Pres.
R. P. Ferringer

Secy. Treas.
H. A. DeWire

Ret. Secy. Treas.
R. R. Kountz

Business Session

New Officers elected for the ensuing year include:

President:—J. O. Fulmer, Tech. Dir., American Testing Laboratories, Lancaster, Pa.

1st Vice Pres.—L. S. Duckworth, Filter Plant Supt., Bureau of Water, Lancaster, Pa.

2nd Vice Pres.—R. P. Ferringer, Plant Engr., Brookville Water Works, Brookville, Pa.

Secy.-Treas.—H. A. DeWire, Reg. San. Engr., Pa. Health Dept., Lewiston, Pa.

Editor—R. H. Snyder, Lehigh Univ., Bethlehem, Pa.

Prof. R. Rupert Kountz, who followed I. M. Glace as Secretary of the Association, retired after six years of service.

The Ivan M. Glace Award for outstanding Water Works service was awarded to Martin E. Flentje, Research Engineer of the Amer. Water Works Service Co. Mr. Flentje was unable to be present to receive the award.

Plans were announced for expanded short school activities. Penn State has appointed Clifford B. Smith, formally of Iowa State University, to the position of Director of Short Courses. Mr. Smith will conduct short schools both in the eastern and western parts of the state. Each course will consist of one day a week for a period of six or eight weeks. There will also be a more advanced short school held at Penn State each summer.

Water Supply in a Free Enterprise System

At the evening session, Joseph A. Beck, Pittsburgh Attorney, (Pres. of the Allegheny Bar Assn) and President of the Bridges Water Co. in Lionsville, Pa. talked on WATER SUPPLY IN A FREE ENTERPRISE SYSTEM.

Mr. Beck pointed out that most private water utilities are in Northeastern United States because that area had cities and towns before there were water supplies, whereas the reverse is true in the midwest and west.

Mr. Beck stated that the water works industry has not kept up with inflation. Water works people are unpopular if rates are raised, but water works must have higher rates if they are to provide the better service to which the public is entitled. There are few water works that should not spend lots of money to improve present service and to be in good shape for the future.

Mr. Beck waxed philosophical in his closing remarks, pointing out that water works men must have an appreciation of their jobs; they have a fundamental responsibility to be of service to mankind. They must realize that everyone's job is routine in spite of the complexity of the future, and they must realize that satisfaction comes from serving one's fellow men.

Cleaning Mains

CLEANING SMALL TRANSMISSION MAINS was the topic presented by Jack P. Miller, Asst. Mgr., General Water Works Corp., Harrisburgh, Pa.

Mr. Miller spoke entirely about the cleaning of mains 6 and 8 in. in diameter. His company purchased the cleaning tools and his own crew does the cleaning job. Among the observations Mr. Miller made on his experience were these:

The "C" Valve of a cleaned pipe line will return to almost the original value after cleaning.

If hydrants are available for blow-off, the main does not have to be cut so often to allow discharge of water.

The amount of corrosion will limit the length of cleaning run possible and therefore determine the number of cuts required in the pipe to provide for removal of muck, etc.

Normally, the cleaning tool can be followed by a man walking along the pipe right of way.

Cleaning 4 in. mains is impossible. It is cheaper to replace a 4 in. line than to try to clean it.

The cost of cleaning runs from 2 to 3 cents a foot, but may run as high as 15 cents a foot if difficulties are encountered and frequent removal of the

tool is required or if auxiliary pumping facilities are needed to move the tool.

No relining is done after cleaning by his utility and he expects the lines to be in use another 15 years before cleaning is required again.

Any costs up to 15 cents a foot have been worth the expenditure.

Well Pumps

WELL PUMP MAINTENANCE was the topic of Earl C. Kohl, Chairman of the Myerstown Water Authority. Mr. Kohl is in business as a well driller and pump manufacturer's representative and was qualified to speak on the subject of well pumps.

In his talk, Mr. Kohl spoke about the several kinds of well pumps; Piston, centrifugal (both splitcase and unit built), deep well centrifugal (both enclosed impeller and open style), water lubricated, oil lubricated and submersible.

Mr. Kohl also spoke of the driving units, for unit built pumps, vertical turbine pumps and submersible pumps. In commenting on these various pumps and motors, Mr. Kohl pointed out the parts which would require maintenance and attention. His paper will be published in *Water & Sewage Works.*

Public Relations

Wallace T. Miller, Research Engineer, Cast Iron Pipe Research Assn., Chicago, Ill., spoke on PUBLIC RELATIONS IN SELLING WATER.

Mr. Miller spoke on the necessity for the appreciation of the need for public relations rather than on techniques. He opened with the definition that "Public Relations is good corporate manners" and said that doing one's job well is a prerequisite to good public relations.

Many small plants think public relations is for large cities which can spend money on special programs. This is not true. Public relations is a vital part of selling water service, regardless of the size of the utility and it can't be turned off at night.

A program of public relations divides into three parts: Employee relations, relations with public officials and relations with the public at large. Public Relations are human relations and involve the matter of how to get along with people. Employees are people and therefore should develop good human relations; it is not for the manager alone. Employees should participate in civic activities.

Among the "things to do", according to Mr. Miller are: Establish a good contact with newspaper reporters; understand the public's point of view; use short schools to train personnel; remember that a public relations specialist can not be hired for every job in the department, therefore all workers must be trained to understand the importance of human relations.

John G. Redman, Manager, York Water Co., York, Pa. also commented on public relations. He pointed out that all of the tools of public relations are free and available in department personnel.

Mr. Redman mentioned these important factors: Courtesy, sympathetic treatment of complaints, honest and objective thinking, honestly admitting mistakes, maintenance of good newspaper relations and avoidance of propaganda for news releases.

Water Works Disaster Planning

R. G. Kluck, San Engr., Kirby Health Center, Wilkesbarre, Pa. spoke for B. S. Bush, Regional Sanitary Engineer of that office, on How TO PLAN TO MEET DISASTER if it comes. The talk was interspersed with frequent reference to the severe and damaging floods of last year, particularly in the Stroudsburg, Pa. area.

Mr. Kluck posed five pertinent questions for all water works men:

1—Do you know your water works system only by memory or do you have accurate maps and records of mains, valves, interconnections, etc.?

2—Do you know where the vulnerable points are in your system?

3—Do you know your original sanitary engineer and how to reach him at all times.

4—Are you a part of the State Civil Defense organization for water works?

5—Do you know what first step should be taken in the event of disaster?

Mr. Kluck listed seven steps to be followed in case of a disaster:

1—Determine if there is any water in the system. Is it contaminated? If contaminated, issue a warning to boil water and use all means to disseminate warning.

2—If there is no water in the system, take steps to provide drinking water by milk trucks, milk cans, etc.

Jack Miller

Earl C. Kohl

— Programmers —

Jos. A. Beck

W. T. Miller

Roq. McShea

R. G. Kluck

3—Determine the extent of the damage.

4—Make repairs as soon as possible.

5—Make water, in repaired system, safe as soon as possible.

6—Remove "Boil Water" edict only after water is safe.

7—Make final restoration of system.

Mr. Kluck showed slides of the damage done at Stroudsburg and said that in last year's storm of August 18-19, 10.1 inches of rain fell, following 8.5 inches of rain in the previous ten days. There were 24 water works affected, serving 600,000 persons in 85 communities. Sixty-seven communities had boiled water edicts (500,000 persons) and ten waterworks systems were out of service for two to three days (112,000 persons affected).

Public Utilities Commission Rates

Roger McShea, Jr. of the Scranton-Springbrook Water Co. and former member of the Public Utilities Commission of Pennsylvania, spoke on PUC SERVICES AND RATES. Mr. McShea's comments were in particular reference to private water works of which there are some 500 in Pennsylvania, some of which are real estate developments and some are civic minded citizens with a well serving their neighbors.

Mr. McShea listed fourteen rules for service, covering such items as accidents, complaints, interruptions of service, inspection records, meters, disputes, etc. According to Mr. McShea, small water utilities have the right to adequate rates. Failure to raise rates when necessary is a sign of poor foresight of management and results in poor operation to the detriment of service. In closing, Mr. McShea explained how a utility should approach the PUC for a rate raise.

Water Works Operators' Clinic*

Vice President L. P. Duckworth, Lancaster, Pa. turned over the chairmanship of the Clinic to George Naylor, Manager of the Riverton Consolidated Water Co. The Clinic featured an open discussion wherein no prepared papers were presented. Operators attending were encouraged to pool their knowledge and experience for the benefit of everyone in attendance. Among the subjects discussed at this year's successful Clinic was the use of plastic pipe for service lines. Four years' experience by one water company indicates sharp stones in back fill should be avoided and lines should be laid at least 4 feet deep.

Time-consuming painting of cyclone fence has been virtually eliminated at Lancaster. Wool mittens of the auto washing type are used to spread the paint. The process can be completed five times faster than when using a brush or roller.

Other subjects covered were: copper tubing corrosion, kerosene spill in raw water, milky water due to air in deep well water, booster station pumps transmitting hum to nearby consumers and experiences using the membrane filter for bacteriological analysis.

*Reported by V. W. Langworthy, Project Engineer, Omega Machine Co., Providence, R. I.

Chlorine Dioxide

Eric Woodward, Technical Service Repr., Olin-Mathieson Chemical Corp., presented a paper on CHLORINE DIOXIDE USES.

Semi plant scale production of sodium chlorite was begun by Mathieson in 1938, with plant scale production beginning in 1940. The chemical is used as the reagent which is acidified with chlorine solution to produce chlorine dioxide. Patents were issued in 1948 to cover the use of chlorine dioxide in water treatment where it is valuable as a disinfectant and in taste and odor control.

Sodium chlorite is available in standard 25 pound pails and 100 pound drums. It is readily soluble in water and will react not only with chlorine in water solution, but with acid and sodium hypochlorite. Best method for determining chlorine dioxide is the oxalic modification of the colorimetric OAT test. Chlorine dioxide may be prepared in the laboratory from sodium chlorite and sulfuric acid. Three thousand ppm may be dissolved in distilled water and remain stable for 30 days in a brown glass bottle stored under refrigeration.

Chlorine dioxide use for algae control at Philadelphia's Torresdale plant was reported by S. J. Cambell. B. F. Johnson reported use of chlorine dioxide at New Castle in destroying tastes from algae and phenols from railroad tank car cleaning plant located upstream. E. R. Westbrook of Berwick discussed the algae taste and odor control using chlorine dioxide. Victor Faivre, Wilmington, Del., Suburban Water Co., used chlorine dioxide to reduce odors resulting from fibermill wastes. Variations in the pollution load, however, make it difficult to maintain adequate treatment.

Activated Silica

A. B. Middleton, Chem. Engr., Philadelphia Quartz Co., spoke on WHAT IS ACTIVATED SILICA and pointed out that actived silica is receiving universal acceptance as a coagulant aid. Used in proper dosages with a coagulant such as alum, it improves filter operation, permits operation over a wider pH range, increases sludge compactness and lengthens filter runs. It increases treatment efficiency at low temperatures by preventing after precipitation of coagulant.

Activated silica is a negatively charged colloidal particle formed from raw sodium silicate and an acidic material. The acidic material may be sulphuric acid, aluminum or ammonium sulphate, sodium bicarbonate or chlorine in water solution. Means of preparation may be batch or continuous. Batch type preparation requires large tanks for aging and holding purposes. Equipment for continuous activated silica production is compact and readily available.

The order of addition of chemicals to water under treatment depends on the plant. Design should be flexible to permit addition of activated silica at points before and after coagulant application. Filter medium should be Anthrafilt, or 0.7 mm sand, filter cleaning efficiency being improved if surface wash is provided.

Cost of activated silica depends on activating agent used and means of purchasing sodium silicate. Cost is estimated at 30-50 cents per ppm of SiO_2 for each 1 mgd.

Silica content of the water is not increased as a result of using activated silica. This is due to the fact that increased solids removal is effected by addition of this chemical.

Activated silica is not a panacea which will solve all coagulation and sedimentation problems but it has proved an effective coagulated aid in many coagulation problems. The standard laboratory jar test will guide an operator sufficiently to determine whether or not activated silica will be helpful at his plant.

— Programmers —

E. Woodward S. J. Campbell B. F. Johnson G. Westerbrook A. B. Middleton J. G. Redman

The C. M. McCord Pumping Station

Named in honor of the retiring Director of Water for Memphis, Tenn.

THE NEWEST filtration plant and pumping station of Memphis, Tenn., originally designated the Northeast Pumping Station, has recently been renamed "The C. M. McCord Pumping Station" in honor of the City's retiring Director of Water, C. M. McCord, Sr.

"Mr. Mac", as he is known to so many, reached the mandatory retirement age of 70 on July 24th, 1956, having been connected with the Water Division of the City of Memphis as General Superintendent, and more recently Director of the Division for the past 23 years.

The C. M. McCord Pumping Station, now under construction, is designed for five motor driven horizontal centrifugal units. Only three units are being installed immediately, with capacities of 5, 10, and 15 mgd. against a head of 175 feet. They will discharge through protective cone valves and Venturi tubes into a looped pipe header. The 10 and 15 mgd. pumps will be driven by variable speed motors operating at 2300 volts. Automatic control is contemplated when conditions warrant such.

The heart of the plant is the central air conditioned Control Room, replete with modern control panels, switches indicating and recording pressure, flow and water level instruments and valve position indicators.

The station exterior is of brick and cut stone as planned by Memphis architects, Mahan & Shapley. The overall building design aimed for compactness and utilitarianism rather than modernism. On the contrary, operating equipment, instrumentation and centralized control represents the very modern along these lines.

Water Treatment

The ground water of Memphis is of ideal quality in all respects except for carbon-dioxide and iron content. The removal of these objectionables is to be realized in the aeration-filtration procedure employed successfully at other Memphis plants. The well water, air-lifted to the surface, is aerated over improved splash-type coke-tray aeration units originally designed a number of years ago by Wellington Donaldson of Fuller & McClintock Engineers. The improved design employs stainless steel trays and bird screens of aluminum fencing. Stainless steel screening is employed to check wind-borne splash and spume from the upper trays. Sectionalizing valves of the butterfly type represent an improvement.

The aerated water will be distributed to four filter units of standard vitrified clay block bottom, gravel and sand, each rated at four million gallons a day, a stepup from the earlier 3 million gallon per day rating at Allen Station. All low-pressure valves in the filter galley will be of the butterfly type, hydraulically operated. Filter wash water will be supplied by a special high volume, low-head pump with a cross connection to the high-service discharge header. The usual loss-of-head and rate-of-flow filter gages will be used. Chlorine will be supplied so that the

*A description of the newest Memphis pumping station taken from a talk before the Memphis Engineers Club by E. L. Filby of Black & Veatch Engrs., Kansas City, Mo.

filter effluent can be sterilized and a small residual carried during the "breaking-in" period, or later if needed. Filtered water will be stored in a 10 million gallon, covered concrete reservoir adjacent to the station.

A staff of but nine men can operate the new C. M. McCord Plant around the clock.

"Mr. Mac"

Christened Claude Manly McCord, the retiring Director of the Water Division of Memphis was born July 24, 1886 in Jackson, Georgia. He is a graduate of the Georgia School of Technology (B.S. in Electrical Engineering) 1906. His first job was with Southern Bell Telephone Co. His first water works job was that

C. M. McCord, Sr.

of Superintendent of Water & Lights at Senatobia, Miss. There he met the captivating Mollie Royall, who in 1913 became "Mrs. Mac". Subsequently "C.M." held various jobs, including electrical design and contracting work, but returned to water works again (1911) as Superintendent of Water & Lights for Atlantic Beach, Florida. After that he found sales engineering more lucrative during his connection with the Wagner Electric Mfg. Co. of St. Louis, Mo. From 1919 to 1928 "Mr. Mac" was President of the Armature Rewinding Co. of St. Louis and from 1928 to 1932, President of the Separator Mfg. Co. of Memphis. Water supply beckoned again in 1933 when he became General Superintendent of the Memphis Water Dept. After a 23 year tenure he retires as Director of the Water Division of Memphis and gets the new C. M. McCord Station named in his honor.

"Mr. Mac" is a past-chairman of the Kentucky-Tennesee Section of the American Water Works Association, a past-director of A.W.W.A. and recipient of the Geo. W. Fuller Award. He is also a past-president of the Engineers Club of Memphis.

Durability of Wrought Iron Pipe Highlighted at Corrosion Show

A section of wrought iron pipe with a service life of more than 37 years was highlighted in a durability contest sponsored by A. M. Byers Company at this year's Corrosion Show held in New York by the National Association of Corrosion Engineers.

Top prize of $100—for coming closest to guessing the service life of the pipe section—was awarded to Norman W. Blaney, a superintendent with the Diamond Expansion Bolt Company, Garwood, N. J. Runner-up honors went to J. H. Drexler, a special representtative of the Goodyear Tire and Rubber Company. He received $25.

The 8-inch diameter wrought iron pipe used in the contest was laid in 1918 when it began carrying crude oil underground from DeLeon to Corsicana, Tex., for the Magnolia Oil Company of Dallas. Recently unearthed, nearly all of the pipeline has been put back to work in low-pressure gas service from Corsicana to Beaumont.

Cryptic Comment

Under the caption "Knowledge Comes Late" an (AP) newspaper item reads as follows:

> CORRY, Pa. (AP)—Borough officials were perturbed when the local sewage treatment plant went on the blink for the second time within two months.
>
> The operator of the plant could not be reached. He was away at State College attending a conference on *"How to operate sewage plants"*.

Traveling Sewer Pipe Christened

A unique christening took place in Middletown, Ohio, when Miss Ohio, of the Miss America contest smashed a bottle of champagne against a mobile sewer pipe.

The stainless steel pipe, made by Armco Drainage & Metal Products, Inc., is actually a large custom-built trailer, holding a complete exhibit of the company's municipal and highway construction products. After the christening, the pipe trailer began a 50,000-mile, 16-month tour of U.S. Cities.

Municipal, county and state engineers and other individuals planning public construction projects will be invited to visit the Steelmobile while it is on the nationwide tour. Armco products on view in the trailer include full scale exhibits of water supply and sewer pipes, drainage pipes, tunnel liner plates, water control gates, highway guard rail, foundation piling, retaining walls and prefabricated steel buildings.

Visitors enter the trailer through an electrically operated door, the upper half of which lifts up and serves as a canopy while the lower half with built-in steps and handrails drops to the street level. The trailer is heated in winter and cooled in summer by a year-round air conditioning unit.

A 16-mm sound movie projector is on board as well as a slide projector. Six sound and color films, covering almost two hours of viewing time, and 13 groups of colored slides are available for showing to engineers who want more detailed product information.

WATER WORKS PRACTICES

Disinfection—Part 2

Chlorine and Chlorine Feeding

The thirty-fourth of a series

by GEORGE E. SYMONS, Ph. D.

Dr. Symons is a Consultant and Technical Editor in Larchmont, N. Y. In this series he discusses *Water Works Practices* in the form of short school lectures, designed to assist operators, students and others who wish to review fundamentals in this field.

D . . . Chlorine

1 . . . History

a. Disinfection by the use of chlorine compounds was introduced in Belgium in 1902, in England in 1905, and in the United States in 1908.

b. Chlorination with chlorine began in this country in 1912.

c. A review of the history of disinfection by chlorination was presented in the lecture on the history of water supply.

2 . . . Properties of Chlorine

a. Chlorine, an extremely active chemical, is never found free in nature.

(1) It occurs in abundant quantities in combination with other chemicals, particularly sodium, as common salt (NaCl).

Fig. 1—HAND TRUCK for chlorine cylinders.
Note rubber tires and straps to hold cylinder

(2) Commercially, chlorine is prepared by electrolysis of salt brine with caustic soda and hydrogen as byproducts.

b. Chlorine exists as a gas at normal temperatures, but may be liquefied under pressure.

c. In the presence of moisture, chlorine is extremely corrosive to metals, except silver, lead, tantalum

TABLE I

Characteristics of Chlorine

Item		Liquid	Gas
Composition (Formula)		Cl_2	Cl_2
Purity (1)		99.9%	99.9%
Color		Amber	Greenish-yellow
Odor			Pungent-irritating
Density—gm/L—0°C, 760 mm		1468	3.214
—lb/cu ft—0°C, 39 psi		91.64	0.2006
Spec. Grav.—760 mm—Air=1.0		—	2.486 (2)
Water=1.0		1.46	—
Vapor Pressure (3)	0°C (32°F)	39 psi	—
	20°C (68°F)	82 psi	—
	40°C (104°F)	150 psi	—
Boiling Point		−34.0°C (−29.2°F)	—
Solubility—gm/100 ml	10°C (50°F) (4)	—	0.98
	20°C (68°F)	—	0.716 (5)
	30°C (86°F)	—	0.572
	40°C (104°F)	—	0.46

(1) At ordinary temperatures, dry chlorine (liquid or gas) will not corrode steel, copper, or other common metals. In the presence of moisture, chlorine is extremely corrosive.

(2) 1.0 lb of liquid will produce 5 cu ft of gas or one volume of liquid will produce 457 volumes of gas.

(3) This pressure is not affected by volume of liquid, hence chlorine pressure gauges are not indicators of amounts of liquid in container.

(4) Below 9.6°C (49.3°F), chlorine combines with water to form solid chlorine hydrate (chlorine ice), $Cl_2 \cdot 8H_2O$.

(5) Approximately 17 gal of water required to dissolve 1.0 lb of chlorine to form saturated solution. For practical purposes, double this value is used.

and Hastelloy C, but the dry gas is non-corrosive.

d. Chlorine gas is a respiratory irritant and attacks the mucous membranes.

(1) Relatively small amounts of chlorine in the atmosphere can be detected easily because of the characteristically pungent odor of the gas.

(2) Higher concentrations in the atmosphere irritate the eyes and cause coughing and labored breathing; continued exposure to high concentrations of chlorine gas will cause death from suffocation.

e. Chlorine is only slightly soluble in water, about one per cent by weight.

f. It is these characteristics of chlorine—its compressibility and temperature relationship, its corrosive action in the presence of moisture, its low solubility in water, and its physiological effects—which have dictated the method of handling and the design of chlorine feeders.

g. The principal chemical and physical characteristics of chlorine are shown in Table 1.

(1) Detailed information on chlorine, its characteristics, handling and feeding is contained in "The Chlorine Manual", published by The Chlorine Institute, Inc., New York City.

(2) An excellent article on the "Principles of Handling Chlorine", by V. W. Langworthy, appeared in the Reference & Data Number of *Water & Sewage Works* in May 1954.

(3) A report by the Joint Committee on Chlorine Supply titled, "Recommended Procedures in the Use of Chlorine at Water and Sewage Plants" was published in the October 1953 issue of the Jour. AWWA.

3 . . . Chlorine Packages

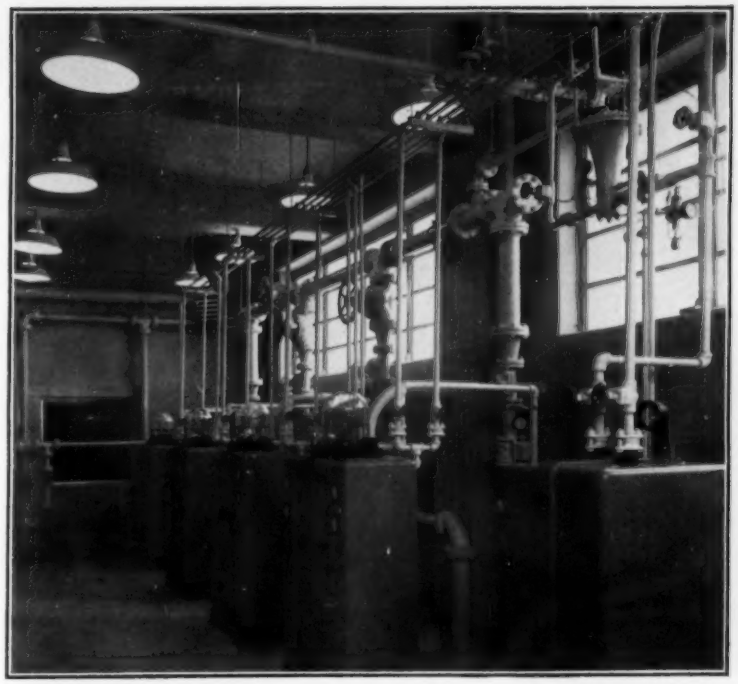
a. Liquid chlorine under 83 psi pressure at 20° C (68° F) is shipped in pressure vessels, of steel construction, equipped with safety devices.

(1) The various sized packages include 100, 105 and 150 lb. cylinders (Fig. 1); 2000 lb. (ton) containers; multiple unit tank cars (15 one-ton containers); single unit tank cars (16, 30, and 55 tons) and tank barges.

(2) Liquid chlorine containers are constructed, filled, and shipped in conformance with rigid ICC specifications.

(3) Packages when loaded have a gas space of 12 per cent (at 20° C) of the total volume to allow for expansion with temperature increases.

b. Cylinders are of seamless steel with a cylinder valve containing a fusible metal safety plug designed to soften and melt between 158° and 165° F. they are fitted with a bonnet designed to protect the valve from impact.



Courtesy Wallace & Tiernan

CHLORINATORS and chlorine evaporators at Houston, Tex.

(1) Cylinders are hydrostatically tested at regular intervals.

(2) Cylinders are thoroughly cleaned and inspected and valves reconditioned and tested before each filling.

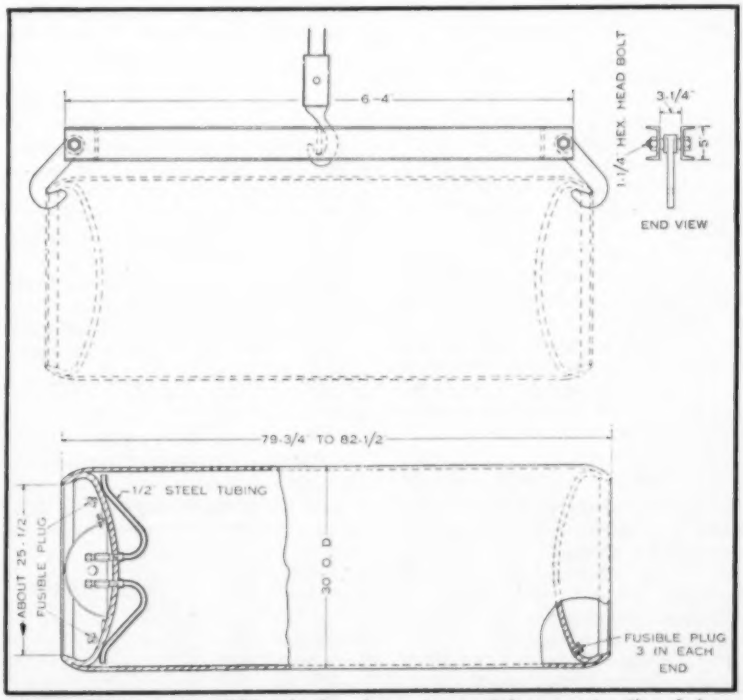
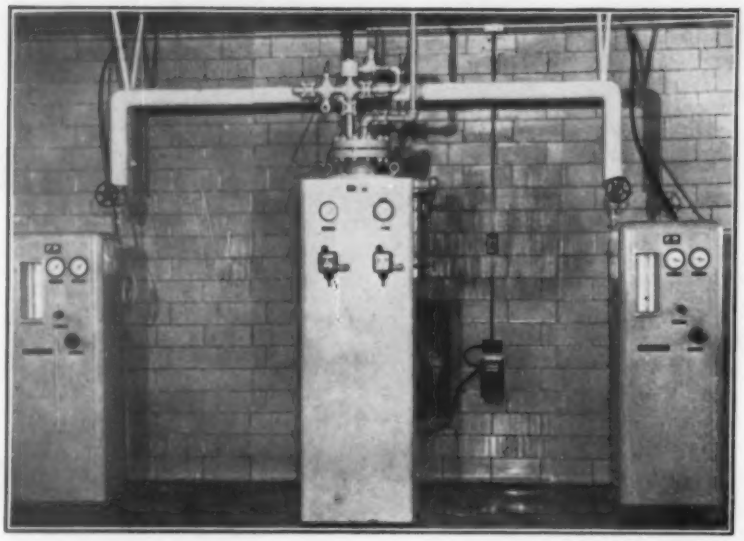


Fig. 2—TON container lifting hooks, above; ton container construction, below.



Courtesy Fischer & Porter Co.

CHLORINATORS and chlorine evaporators at Columbus, Ohio.

c. Ton containers are of steel construction with ends dished to form a chime crimped inward to provide a grip for hooks; (Fig. 2).

(1) Ton containers are equipped with two identical valves without fusible plugs.

. . . Valves are protected by a removable steel hood except when the container is in use.

. . . The valves are connected to eductors reaching opposite ends of the tank diameter.

. . . Three fusible metal safety plugs are placed in each end of the container.

(2) When the container is in a horizontal position, with valves aligned vertically, chlorine can be withdrawn, either as a gas or liquid.

d. Tank cars and barges are welded steel construction, covered by insulation and protected by a light steel jacket.

(1) A dome in the center top of the tank contains two valves for liquid and two valves for gaseous chlorine.

(2) A safety valve will relieve pressure under abnormal conditions.

(3) An automatic check valve will shut off chlorine flow if a delivery line should break.

4 . . . Chlorine Storage

a. Store cylinders upright (and cradle ton containers horizontally) in a cool dry place.

b. Storage space should be well-ventilated, away from heat sources, walkways, elevators, stairways and ventilating system intakes.

(1) Indoor storage should be above ground and fire proof.

(2) Outdoor storage should provide protection from direct sun, snow and debris.

5 . . . Chlorine Handling

a. Certain precautions must be observed in handling cylinders and containers.

(1) Ton containers require a hoist and lifting clamp for handling (Fig. 2).

(2) Cylinders may be clamped to a balanced hand truck for moving (Fig. 1).

(3) Lifting magnets, chains or rope slings should never be used for handling chlorine packages.

(4) Chlorine pressure vessels should never be dropped or allowed to strike one another with force.

b. Certain practices are considered essential in the handling and use of chlorine containers.

(1) Containers should be used in the order received and return empty containers promptly.

(2) Connections should be made only with approved fittings.

(3) Valves should be opened slowly, one complete counter-clockwise turn, using a wrench no longer than six inches.

(4) Leaks should be tested for with ammonia and corrected immediately, if found.

(5) When scales or chlorine records indicate an empty container, the valves should be closed, the tank disconnected and valve tested for leaks; then the container should be capped and marked for return to the supplier.

c. Materials used for handling chlorine depend on whether the chlorine is liquid, dry gas, or moist gas.

(1) Dry chlorine gas or liquid under pressure may be handled in extra heavy black iron, wrought iron or steel pipe, copper tubing or other metals which will withstand higher pressures.

(2) Flexible copper tubing connectors, termed whips, are used to connect chlorine cylinders and ton containers and tank caps to feeders or manifolds and for conveying gas or liquid chlorine.

(3) Dry chlorine gas, under low pressure or vacuum, is conveyed in hard rubber, Uscolite, Polyethylene and other plastics as well as in the same materials as gas under pressure.

(4) Moist chlorine can be handled only in glass, rubber, hard rubber, plastics, silver, and other corrosion-resistant materials.

(5) Chlorine solution can be handled only in hard rubber, rubber lined or Saran lined piping, rubber-lined hose, Polyethylene hose or Uscolite piping.

d. The amount of chlorine that can be discharged from a container depends on the type of container and the temperature.

(1) Table 2 shows these relations.

(2) When one container will not discharge enough gas to meet the needs of the plant there are two methods that can be employed to provide the required gas.

. . . Two or more containers may be connected to a manifold.

. . . Liquid chlorine may be delivered to a heated evaporator where it is converted to gas.

TABLE 2

Relation of Temperature to Chlorine Container Discharge

Temp °F	lb chlorine discharged per day		
	cylinders		Ton Containers
	105 lb	150 lb	
40	6	9	100
50	14	21	240
60	23.7	35.5	285
70	32	47.5	536
80	41.2	62	700

E . . . Chlorine Feeders

1 . . . Types of Feeders

a. In the lecture on Chemical Handling and Feeding, chlorine gas feeders were classified in three ways:

(1) Basis of state of chlorine as fed.

. . . Pressure type feeders for direct feed, sometimes termed "dry feed", wherein the gas is introduced directly through a suitable diffuser at the point of application.—This method is used infrequently because of operating difficulties and hazards.

. . . Solution type feeders, in which the chlorine gas is controlled, metered, and introduced into a stream of make-up water and then conducted as a solution to the point of application.—For most applications the solution type feeder is recommended.

(2) Basis of design features as applied to solution feeders.

. . . Hydraulic

. . . Hydraulic-mechanical

. . . Mechanical

(3) Basis of method of applying vacuum as applied to solution feeders.

. . . Vacuum type in which the chlorine is maintained under vacuum throughout the apparatus.

. . . Partial-vacuum type in which the vacuum is maintained only during the time the eductor is in operation.

. . . Pulsating type feeders are similar to the partial-vacuum type except for the metering device.

2 . . . Types of Control

a. There are six degrees or types of control available in modern chlorine gas feeders: Manual, Semi-automatic, Program, Proportional, Automatic, and Combination.

b. Manual control—the simplest method.

(1) An operator initiates the actual control of a feeder by turning on the chlorine at the cylinder, opening the water valve or valves and setting the rate of feed by means of a rate control device.

(2) Treatment is established in terms of pounds of chlorine per day from his knowledge of the chlorine demand and the flow to be treated.

. . . If there is a change in flow or demand the operator will have to change the rate control device.

c. Semi-automatic control

(1) Operation of the chlorine feeder is interconnected with a primary unit or device so that the feeder will operate at a fixed rate in conjunction with operation of the primary unit or by a change in a measured variable.

(2) This is simple automatic start-stop operation of the feeder at a fixed rate in response to the operation of a primary unit (for example, a pump) or in response to some measured variable (for example, flow).

. . . The feed rate in pounds of chlorine per day remains constant as manually set by the operator but the feeder starts and stops with the pump or flow.

. . . This type of control is usually employed for treating pumped flows where pump operation is intermittent at relatively constant rates of flow.

d. Step control

(1) A form of semi-automatic control in which the chlorine feed rate is varied in definite increments as the operation of a primary device is varied by definite increments of output.

(2) When several pumps come on line in sequence, the feeder output will be increased in step-wise delivery quantities to meet the increased chlorine requirement.

. . . Each rate control device is previously set by the operator to the proper value for the flow produced by the combination of pumps in operation.

. . . As more pumps come "on the line" the rate of feed will increase by the pre-set increments.

e. Program Control

(1) Either start-stop operation or the rate of chlorine feed or both, is controlled according to some predetermined pattern with respect to time.

(2) One type of program system is "time-cycle" control, similar to semi-automatic operation except that it uses a timer or electric program controller as the primary unit or device to produce start-stop operation at a fixed manually set feed rate in accord with a predetermined time cycle.

(3) A more complex system can be applied to step control to produce both start-stop operation and chlorine feed at one of several fixed preset rates in accord with some time cycle.

(4) Another system is "time-program" control, which uses a cam-operated pneumatic device, termed variously, time-program, time-schedule, or time-pattern controller, or program-transmitter.

. . . This device will vary the rate of chlorine feed through the entire range of the feeder over the time required for the cam cycle, usually 24 hours.

f. Proportional pacing (Fig. 4).

(1) The rate of feed of the chlorine feeder is controlled by and responds to a variation in a measured variable, (for example, flow).

(2) The chlorine dosage in lb per mil gal is manually set and this dosage or ratio is maintained by the proportioning control device regardless of changes in flow rate.

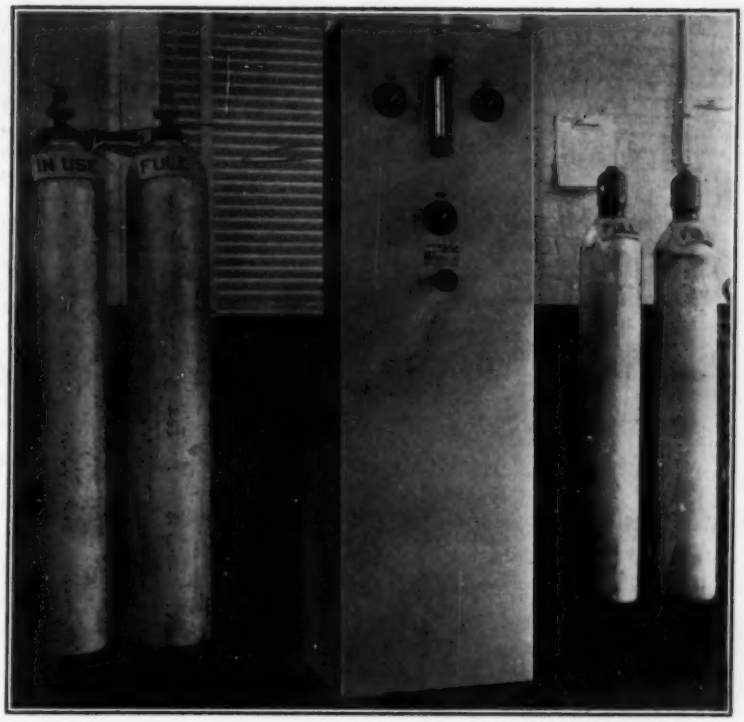
g. Automatic control

(1) Automatic self regulation is obtained by means of feed-back (automation) whereby the chlorine feeder is regulated by the results of chlorination; i.e. residual chlorine, or oxidation-reduction potential.

(2) This method of control is receiving more and more attention, particularly where oxidation-reduction reactions are involved.

. . . Control from chlorine residual is still in the development stage.

h. Combination control using any combination of these various types of control can be employed for particular applications.



Courtesy Builders-Providence, Inc.

CHLORINIZER at Pennichuk Water Works, Nashua, N. H.
Note chlorine cylinders and labels

Courtesy Everson Mfg. Co.

STERELATORS at Port Washington, Wis.

3 . . . Installation Practices

a. Selecting the location for chlorine feeders in a plant must include consideration of five factors.

(1) Point of application

. . . There must be (1) quick and thorough mixing of the chlorine solution with the liquid to be chlorinated and (2) sufficient contact time to effect the desired disinfection.

. . . There should be (1) low pressure at the point of discharge of the chlorine solution, and (2) short runs of chlorine lines from feeder to application point.

(2) Accessibility of the equipment with respect to point of application, water supply, the operator, handling and storage facilities, electric power, governing means and suitable drains.

(3) Space requirement of equipment must consider accessibility to all elements for convenience in operating, servicing, and maintaining; storage space, extra container space; handling facilities.

(4) Heating facilities must be provided to assure satisfactory control of temperature in both the feeder area and the container area.

(5) Safety conditions

b. Arranging the equipment within the selected areas must include consideration of twelve factors.

(1) Chlorine gas feeder
(2) Scales and cylinders
(3) Chlorine piping
(4) Gas manifolds and pressure reducing valves
(5) Solution manifold
(6) Solution piping
(7) Water supply piping
(8) Booster pump, if required
(9) Vent line to atmosphere
(10) Control and metering devices
(11) Evaporators
(12) Gas masks, antidote solution, chlorine safety chart.

4 . . . Dissolving and Dispersing

a. Chlorine gas can be introduced under pressure directly into a large flow of water, but because of its low solubility, special provision must be made for dispersion of the gas.

(1) A closed system must be under pressure.

(2) In an open system there must be a depth of 10 to 12 ft of water over the diffuser to the point of application.

b. If delivered by solution feed, a relatively stable solution is produced in the chlorine feeder by mixing the chlorine with water passing through the feeder ejector.

(1) The quantity of water required will vary with the capacity of the feeder and both quantity of water and pressure will vary with the back pressure existing at the point of application.

(2) Table 3 shows the data for estimating the water requirements of solution type chlorine feeders.

TABLE 3
Water Requirement for Chlorine Solution Feeders

Back Pressure psi	Oper. Pressure Required psi	Water Required: Feeder Cap up to 100 lb per day (gal/min)	Water Required: Feeder Cap above 150 lb per day (gal/lb Cl_2)
0	30	5	50
10	50	9	90
15	55	9.3	93
25	65	10	100
30 & up	2.2 x back press.	$1.25\sqrt{\text{oper. psi}}$	$12.5\sqrt{\text{oper. psi}}$

5 . . . Safety

a. Safety conditions with respect to installation of equipment are improved by:

(1) Outside entrances to chlorine feeder room and container room.

. . . Doors should swing outward.

(2) Ventilation of both feeder and container areas.

. . . Forced ventilation should be provided to clear the areas in event of accidental escape of gas.

. . . Exhaust fan, controlled from switch outside the area, should take suction at the floor and discharge outside the building, where dilution is possible and where gas will not seep back into the building.

(3) Dousing facilities with caustic soda solution for containers with leaky valves.

(4) Separate storage room for container.

(5) Separate chlorine feeder room.

(6) Gas masks and first aid antidotes located outside the feeder and container areas, but nearby.

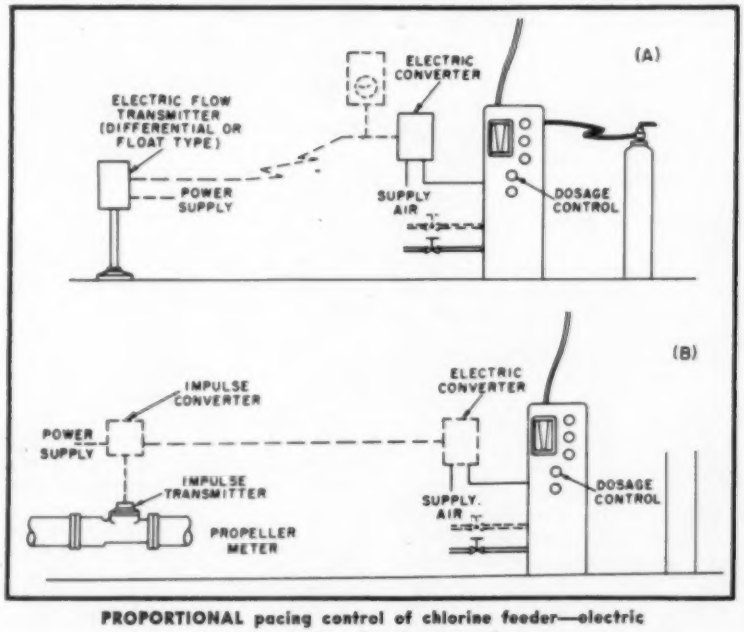
. . . Use cannister-type masks (U. S. Bur. of Mines approved).

b. Safety conditions with respect to operation of equipment can be improved by following these rules.

(1) Hold ammonia-moistened cloth near a suspected area to locate leaks by a white cloud.

. . . A plastic squeeze and spray bottle is even better.

(2) Replace gas mask cannisters



PROPORTIONAL pacing control of chlorine feeder—electric

A—Paced from a chronoflo telemetering flow system
B—Paced from a propeller or rotary type flow meter

after each use.

(3) Handle all containers as though they were full.

(4) Never apply direct heat to a chlorine container.

(5) Do not tamper with fusible plugs or alter or repair tanks.

(6) Remove valve protection hoods only when containers are in use.

(7) Do not hoist containers by the hood.

(8) Correct leaks at once; they never get better.

. . . Never apply water to a chlorine leak or leaking container.

(9) Place a leaking container so that only the gas will escape and move it to an isolated area or immerse in caustic soda solution or slurry of hydrated lime.

(10) Notify chlorine supplier in case of emergency.

(11) Call a physician in case of an accident.

NEXT LECTURE—Disinfection—Part 3.

Correction

In the lecture on Taste and Odor Control, Part 2, which appeared in the Aug. 1956 issue there were two errors with respect to illustrations.

On page 350—Fig. 2, the legend under the cut should read "Fig. 2—Examples of algae—asterionella, left; snyura, right."

On page 353—the illustration of the "activated carbon powder bag in position for opening" shows the bag right side up; actually "in position for opening", the bag should be upside down.

Let's be Realistic About Meter Accuracy

Dear Bill:

This morning a mutual peddler friend of ours happened to be in the office and during his visit said you were thinking about setting up a meter repair shop and a meter testing and maintenance program. Before you do I would like to tell you, briefly and without much detail, what we found out about the feasibility of this same project for the water works system here. Because our town and yours are alike in many respects I believe you will be interested in the results we got.

As you know, our system is fully metered, and all but about a hundred of the twenty-nine hundred customers we have are served through five-eighths inch meters.

The bit of research we did started a while back when one of our councilmen asked me why we did not bring meters in for testing and overhaul at planned intervals instead of waiting for them to stop before replacing them. He also wanted to know why we sent them to the commercial meter repair shop in the big city when we ought to try to keep that money at home. This fellow is pretty sharp and can spot an answer that is largely an opinion. Although we felt certain that our way of handling meter maintenance was best for our city, we had never made much effort to prove it; so, we went after factual proof that what he was suggesting would sink our budget so deep it would take another water rate increase to rescue it.

Records of gallonage sold and how many customers we billed told us that the average customer use was well above the four thousand gallons allowed by our minimum monthly bill, but casual glances through the customer ledger sheets always disclosed what I thought were an awful lot of minimum bills. Apparently our averages did not give the whole story.

Using the previous twelve months supply of billing tapes—(the meter books would have done as well)—we made a tabulation of the number of customers billed at each two hundred gallon interval, from the lowest usage to the highest. Using these figures we calculated for each interval the accumulated percentage, both of customers and of gallonage. The results were then plotted as percentage of total customers versus percentage of total gallonage and the curve we got confirmed our belief that average-customer-use figures meant very little.

For instance, we found that 50% of the customers used only 30% of the total gallonage sold; half the water sold was used by 70% of them; and, as the clincher for us, 78% of the customers were billed for 60% of the water sold. These figures proved that over three-fourths of our customers were receiving only minimum bills for four thousand gallons or less per month. An amazing figure, so far as we were concerned.

Then, What Part Did Meter Accuracy Play?

We studied the curve for awhile, asking ourselves what we would gain if metering accuracy were to be improved. Here are our conclusions:

At best it would shove only a very small percent of our accounts up over the minimum billing line even if *all* our meters were slower than they ought to be—which is most unlikely—and there would be no effect whatever on the revenue produced by the large remaining number still qualifying for minimum billing, no matter how accurate we could meter these accounts.

True, it could benefit the meter registration in the case of the other 22% of the accounts, but, here, too, looking at it in a practical way, we asked ourselves how many of those six hundred and forty or so meters were likely to be under-registering beyond standard limits. The only fair answer was that there would not be a whole lot of them. Even if all were too slow, the additional income produced by bringing their accuracy up to within standard limits—and keeping it there—would be insufficient to bear the expense created by the effort.

Now, as for setting up a meter repair shop, our records tell us that, on the average, a little less than one per cent of our installed meters become inoperative in a given month for one reason or another. We find no justification for incurring the expense created by a meter shop that would be servicing twenty-five or thirty meters a month. For one thing, whoever did the work would have to have a shop to work in, modest though it might be, and, regardless of how much or how little it is used, the fixed costs of the shop go on and on, and they must be met with money from somewhere. Too, I do not believe it is good practice to repair meters on a part-time basis. You just fool yourself when you put someone to fixing meters—and I use the term advisedly—whenever he has nothing better to do. The quality of work from such an arrangement ordinarily leaves much to be desired.

I hope I haven't thrown too much cold water on your plans, but let me urge you to look at the costs involved—all of them, direct and indirect—before you go too far. See what the benefits will be, if any. Find out what to expect in the way of more revenue, which, after all, is the real purpose of the project. If the cost is less than the extra income produced, well, then you have something worth while and you ought to get going on it right now. For the average small system, though, I doubt seriously whether it can be anything other than a loss operation. None of us can afford that and the smaller our system is the more this is apt to be true.

Yours, Hank

CAR UNLOADING room for chemicals with dust collectors on storage bins

Taste and Odor Control With Activated Carbon*

by E. A. SIGWORTH

Mr. Sigworth is associated with the Water Purification Division of Industrial Chemical Sales Division of the West Virginia Pulp and Paper Co. In this article he has revised and brought up to date a discussion of the subject which he wrote several years ago.

WATER WORKS operators today are called upon to furnish an abundant supply of water, and to make it readily available to meet the many and varied uses of our modern civilization. Present water purification practice has developed to the point that the great majority of plants are delivering clear, safe water at all times, but this excellent record is often marred when plants deliver an unpalatable water.

The water works operator fully realizes that presence of tastes or odors in the water supply is not necessarily an indication that the water is unsafe to drink. The average consumer, however, feels that odor in water is an indication of pollution, and he may travel great distances for a more palatable but perhaps less safe supply. Such experiences have frequently resulted in water-borne epidemics in communities, in spite of the fact that the municipal supply has been thoroughly protected by application of chlorine for disinfection purposes. From the viewpoint of the health of the community as well as good public relations, it is, therefore, almost as essential to furnish a palatable water as it is to furnish one which is clear, sparkling and free of any harmful impurities. If bottled water is widely used in a community, it is time to take a critical look at the water purification processes.

With existing methods for taste and odor control, there is no longer any excuse for delivering water containing any odors, whether they be chlorinous, earthy, fishy, moldy, musty, or any of the legion of odors possible in present-day water supplies.

A great number of plants throughout the country are consistently delivering palatable water at all times even though their raw water may at times contain high concentrations of odor. This trend towards delivering a quality product naturally costs money. If, however, the water plant official will calculate the cost on a per capita basis, he will find that it will amount to only a few cents per capita per year. Certainly no consumer could object to paying such a minor cost for a consistently palatable water.

* Ed Note: Although tastes and odors are generally considered to be a summer problem, we are apt to forget that this problem exists in the warmer states from early spring to late autumn and the year around where industrial wastes are involved.

Causes of Odors

Algae growths are the most frequent offenders where taste and odor are concerned. Although there are many varieties of algae, those most likely to cause taste and odor are limited to about 25 to 30 species. During their life cycle, these algae give off odorous compounds to the water, and each algae type will give off its own characteristic odor.

A more recent theory on algal type odors has been proposed. This theory is based on the association of actinomycetes with algal growths, and it is reported that odors are actually due to these associated growths rather than to the algae themselves. Regardless of whether odors are due to algae or actinomycetes, the fact remains that such odors still do constitute the most frequent cause of odor in water supplies. The second most frequent cause of odors is decaying vegetation resulting from decomposition of vegetable matter such as grass, under-water weeds, leaves, etc. Odors caused by industrial wastes are becoming much more frequent with the great industrial expansion throughout the country. Although industrial waste odors are less frequent offenders, the concentration of odors can frequently be very extreme. Under such conditions, the water plant official must often use every available method to reduce these odors to a palatable level.

The statement "an ounce of prevention is worth a pound of cure" is very appropo where odors are a serious problem. Therefore, preventive measures should be adopted, such as copper sulfate treatment for algae control, dredging or damming off shallow areas, and cooperation with industrial plants on the watershed area in order to attempt to reduce trade waste pollution.

Evaluation of Odors

The development of the "Threshold Odor Test" has provided the water works industry with a satisfactory means for odor evaluation. This test involves diluting a sample of water with varying amounts of odor-free water until the point is reached where odors are just detectable, and further dilutions show no detectable odor. By this method, odor concentrations can be assigned definite numbers directly proportional to the odor concentration. For example, an odor number of 20 would be 10 times stronger than an odor number of 2. Thus, this test provides the water works operator with a means of determining when it is necessary to institute corrective methods for odor control.

ROTODIP chemical feeders for activated carbon slurry

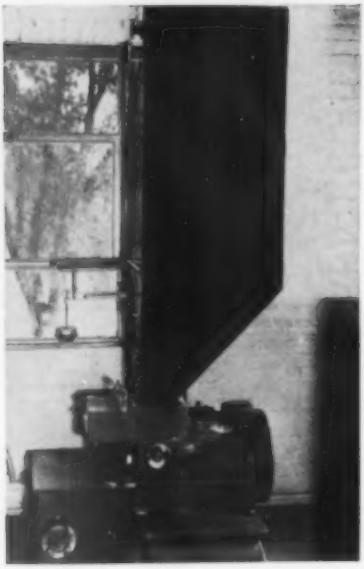
With this test, it is possible to measure the relative efficiency of various treatment methods and chemicals, to determine when the water is palatable, and to determine the best point of application for corrective treatment. It has been estimated that a threshold odor value of 5 will normally constitute a palatable level for the average consumer. This value assumes an observer with average sensitivity and is based on odor evaluations being conducted on heated samples (60°C), which gives higher odor values than those determined on cold samples. If the operator is super-sensitive to odors, the level of palatability might have to be increased and vice versa.

Activated Carbon

Activated carbon, as most frequently used in water treatment, is a very fine black powder. It acts by the phenomenon termed adsorption, which should not be confused with absorption. The concentration of certain specific substances at exposed surfaces is known as adsorption. On the other hand, the picking up of water by a sponge is known as absorption. If a container is filled with a dye solution and sponge inserted in the solution, absorption takes place. The sponge takes up both water and dye without any change in concentration. Removing the sponge and squeezing it would be the same as pouring some of the dye solution out of the container.

On the other hand, if a piece of clean cloth is dipped into the dye solution, there will be a greater proportion of the dye taken up on the cloth. If successive pieces of cloth are dipped into the dye solution, it will be possible to note a distinct lightening of the color of the dye solution. This phenomenon of chemical substances adhering to solid surfaces is known as adsorption.

If activated carbon is added to a dye solution, it is frequently possible to obtain complete removal of the dye by adsorption. This phenomenon is explained by exposure of clean surfaces, where impurities can concentrate and thus be removed from solution. This is one of the reasons that the carbon used in water purification is such a fine powder. Extremely small particles result in a greater degree of surface exposure, and the porous structure of activated carbon adds to this great amount of surface. Extremely clean surfaces may be considered as the really active patches on which maximum adsorption takes place. So great is the surface exposure obtainable with activated carbon that it has been calculated that one solid cubic inch of activated carbon can account for internal and external surface of approximately 10,000 square yards. It has also been estimated that one gram of activated



BAG LOADING dust free dry feeder mounted on scales

carbon (about one normal heaping teaspoonful) will contain approximately 120 billion particles.

The fineness of the carbon particles, coupled with their porous character, gives another advantage in water treatment by permitting the carbon particles to disperse widely throughout the water and remain suspended for long periods of time. This dispersion and suspendability permits greater opportunity for odorous substances to come in contact with the active surfaces, which then attract and hold the impurities on the carbon surface. As the carbon particles settle out or are removed by filtration, the odorous compounds are also removed. Thus adsorption of taste and odor with activated carbon actually removes the offender from the water. Activated carbon does not change the odor to some less offending compound nor does it mask objectionable odors.

Dry Feeding Activated Carbon

Activated carbon is insoluble in water and since it is rather difficult to wet, must be applied as a slurry. It can be fed by dry-feed machines which proportion the dry carbon, after which it is wet in a solution box and subsequently applied as a carbon slurry. The predominant method of applying carbon is through dry-feed machines, many of which are available on the market today.

Occasionally some difficulties are encountered with dry-feed machines, so that the following suggestions are worthy of consideration. The feeding hopper should be so designed that powdered carbon will not bridge in the hopper, thus preventing carbon from reaching the feeding mechanism. The capacity of the dry-feed machine should be more than ample to take care of the most severe odor condition likely to develop within the water treatment plant. The solution box should be designed so as to wet the carbon completely, and the water ejector should be of ample size and capacity to carry the carbon slurry away, even when the machine is operating at maximum capacity. All feed machines handling carbon should be equipped with dust collecting systems to eliminate escape of some of the fine particles as dust.

Slurry Feeding

In the early development of activated carbon in the water field, many plants used slurry methods of feeding. As activated carbon assumed a permanent place in water purification practice, dry feeding equipment was adapted and later specifically designed for handling carbon. Many of the large users are returning to slurry feeding methods, now that carbon can be delivered in bulk hopper cars.

When the shipment arrives at the plant, the carbon is discharged through the hopper bottoms into underground tanks. Here the carbon is slurried with water and stored until it is needed. When it is to be used, the carbon slurry is pumped to proportioning devices such as Rotodip feeders, displacement pumps, etc. and thence to the point of application. Actual development of this apparently simple procedure was fraught with many difficulties, such as wetting the carbon, design of equipment, etc. Credit for developing this method of feeding into a practical and efficient procedure should go to water treatment personnel of the City of Chicago. Since the first installation at their South District Plant in 1949, perseverance in improvements has finally resulted in solving the many problems encountered. For information on the subject their reports should be consulted.

Points of Application

In a water treatment plant, carbon should be applied at a point prior to filtration or, if no filters are available, prior to coagulation and settling. Thus in the normal water treatment plant, carbon can be applied to the raw water, mixing basin, settling basin or directly to the filters.

Where odors develop suddenly they may get through the plant before being detected; when this happens the carbon should be applied either on top of the filter or to the filter influent. In this manner, carbon is applied to that water which will first reach the consumer. This point of application is most frequently reported to give the greatest efficiency from the carbon for removal of tastes and odors. In many cases, surprisingly low carbon dosages are reported to give exceptionally good results in removing tastes and odors from water supplies by application to filters. Where odors are usually at low concentration or appear at infrequent intervals, this point of application is usually recommended.

If high dosages of carbon are necessary to correct an odor condition, application of carbon to the filters may result in high loss of head and possibly in the passage of carbon through the filter beds. Therefore, where carbon is used continuously, it is recommended that the point of application be moved so that it is applied at a point appreciably ahead of filtration. Also, where dosages in excess of 50 lb per mil gal (6 ppm) are necessary, carbon should not be applied to the filters for any prolonged period of time. Under such circumstances, application to the mixing basin or to the raw water is recommended. In some cases, carbon has been applied part way through the settling basin, but caution should be taken to insure that the carbon will have an opportunity to disperse rather uniformly throughout the entire body of water to be treated.

Effect of Other Chemicals

Most efficient adsorption with activated carbon is usually accomplished at pH values below 9.0, because alkalies sometimes react with odorous substances to form salts which are quite difficult to adsorb. Phenol is a specific example, since sodium phenolate can be formed at pH values above 9.0. Carbon surfaces should never be made alkaline, therefore, it must never be mixed with alkaline materials such as lime or soda ash. Although carbon and lime can be fed to the same point of application, they should not come in contact beforehand.

Special consideration must be given to the influence of chlorine and carbon together. Chlorine bearing compounds and carbon should never be mixed together in a dry state, because the chemical reaction can be sufficiently violent to cause an explosion. This reaction does not take place in water, so that chlorine and carbon *can* be applied at the same point of application. It is very desirable, however, to separate the points

of application by at least 5 and preferably 15 minutes, because carbon tends to adsorb chlorine thus curtailing the effectiveness of both chemicals. In a few instances, carbon should follow the chlorine, but in the majority of cases carbon should precede the chlorine. One reason for this order is that chlorinated compounds are usually more difficult to adsorb with carbon.

A further advantage to feeding carbon first is that it can adsorb organic compounds, which are responsible for chlorine demand, and thus lighten the load for chlorine. Actual tests have demonstrated that the same residual can be carried through the plant with 25 to 40 per cent less applied chlorine. Although savings in chlorine do not pay for the carbon, the treatment costs where carbon is required can be very substantial. Many of the existing treatment plants do not have the physical set-up to separate the points of application, but it is hoped that designing engineers will make suitable provisions in new treatment plants.

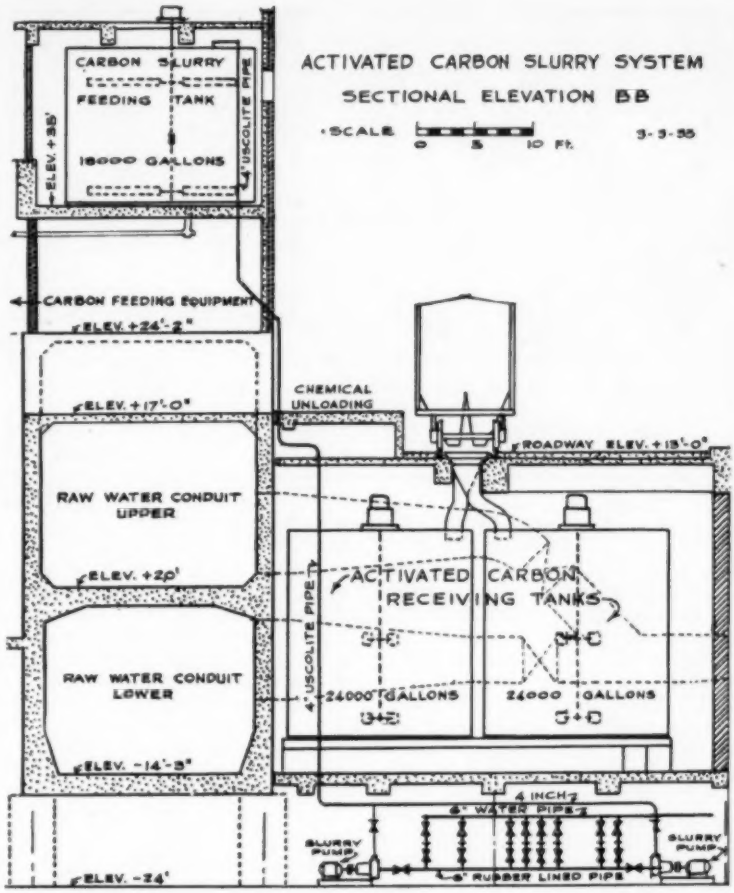
Determining Carbon Dosage

In many cases, particularly where suitable laboratory facilities are not available, the carbon dosage is determined in actual plant practice by "hit-and-miss" methods. This can frequently result in over- or under-dosage. Fortunately, over-dosing with activated carbon can have no ill effect other than on the pocketbook, because it acts on physical rather than chemical principles. Where costs are of prime consideration, scientific methods are recommended.

In the laboratory, the "Threshold Odor Test" is very successfully used in determining the carbon dosage. The first consideration is to know the extent to which odors must be removed in order that a palatable water can be delivered. For this purpose, a taste and odor panel of personnel is recommended, consisting of at least four individuals. Samples of raw water should be chlorinated sufficiently to make the water safe for testing purposes, and then dechlorinated to avoid interference by chlorinous odors. This water can then be filtered and diluted with varying amounts of odor-free water for tasting purposes. That sample having the least dilution of odor-free water, which is pronounced acceptable by all four tasters, can usually be considered as the palatable limit. A threshold odor test can then be conducted on this sample, and the threshold number will represent the value which must be attained in actual practice.

Having determined the palatable level, samples of water should then be treated with varying amounts of activated carbon. A sample should be collected at a point just prior to any carbon application. If carbon is not being used, a sample of raw water can be collected. To various samples, not to exceed four in number, different dosages of activated carbon should be added. For example, 2, 4, 8 and 16 ppm. If odor concentration is considered to be rather high, it would be desirable to use higher carbon dosages than suggested above.

After addition of the proper carbon dosage, each sample should be treated exactly the same as the existing treatment in the purification plant; this will include alum, lime, chlorine, etc. Contact times should parallel as closely as possible actual detention times in the plant. Samples are finally filtered, preferably through glass wool as the filter medium. This glass wool and all receptacles should be thoroughly rinsed with odor-free water to assure that extraneous odors are not added to any of the samples.

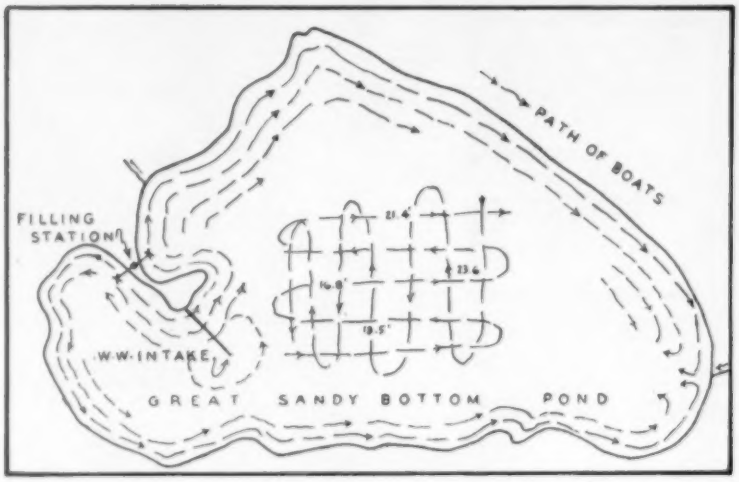


Courtesy of J. R. Baylis

DIAGRAM of handling and storage facilities for activated carbon slurry at Chicago, Ill.

Finally, these treated samples and also a sample of the raw water should be evaluated for threshold odor number in accordance with the procedure in 'Standard Methods." Results obtained should be plotted on arithmetic graph paper and the curve drawn as accurately as possible to conform to the plotted points. From this curve, it should be possible to determine the carbon dosage necessary to produce the threshold number previously determined as acceptable for a palatable water.

In transposing these results to actual plant practice, it should be borne in mind that activated carbon accomplishes better results in plant practice than in small scale laboratory tests. *Therefore, it is desirable that the dosage determined in the laboratory should be cut in half for the first plant test.* Usually it will be found that half the laboratory dosage will give the desired results in plant practice. Some exceptions to this generalization have been encountered so that the final



Courtesy H. E. Bailey & J. Studley

RESERVOIR treatment by boat

Course of boats for 108 acre, 300 mil gal reservoir

plant dosage may have to be increased or decreased to give optimum results. For example, if it is found that a laboratory dosage of 12 ppm of activated carbon is necessary to reach the palatable level, only 6 ppm should be employed in the first plant scale test. Based on results obtained in the plant, it may be necessary to revise the carbon dosage to as low as 4 ppm. or perhaps as high as 8 or 10 ppm. Such relations, once developed between laboratory and plant results, can usually be utilized on a basis for any subsequent tests and dosages.

Unfortunately, it is not possible to set any hard and fast rule as to the amount of carbon necessary, even though the threshold number of the raw water is known. For example, in some plants it has been found that one part per million of carbon is necessary for each threshold odor unit to accomplish palatability. Yet, in other parts of the country, this ratio may be one part of carbon for every three or four threshold odor units.

The type of odorous compound is also a contributing factor to this ratio. Therefore, if the type of odor changes suddenly, it is desirable to conduct another evaluation in order to determine the necessary carbon dosage. The reason for this is that some compounds may be easier or more difficult to adsorb by carbon. Also it should be borne in mind that as odor intensities increase carbon dosages may have to be greatly increased. In other words, if the odor concentration suddenly doubles, it may be necessary to use three times as much carbon in order to remove the objectionable odors. In any case, laboratory tests can constitute a very valuable guide in determining the optimum carbon dosage for plant scale use, always bearing in mind the relation between laboratory and plant results.

In actual plant operation, carbon dosages used will vary from as low as 2 lb per mil gal to as high as 1000 lb per mil gal. Extremely high dosages such as 500 lb per mil gal or more are rather rare and, fortunately, are usually of only very short duration. Although costs of treatment during these short periods of time would seem to be enormous, the average cost over the year is usually found to be very reasonable. If the total carbon costs are calculated on a per capita per year basis, it will be found that the annual cost is very nominal.

Reservoir Application

Difficulties with unpalatable water unfortunately do not limit themselves to systems where water purification facilities exist. Unfiltered reservoir supplies are perhaps even more likely to have odor difficulties, particularly of the algae type, because the water must be clear in order to be suitable for delivery to the public. Since algae thrive more particularly in clear waters, impounded supplies must always face this problem.

Since activated carbon is a fine black powder which will give a black turbidity to water, it is desirable that treatment be conducted so that little or no carbon reaches the distribution system. The general practice is to treat reservoirs with activated carbon so that no carbon is applied at any point near the reservoir intake. Thus the carbon particles have an opportunity to settle from the water, and any small amount that might get into the distribution system would not be noticeable to the consumer.

In some instances, carbon has been applied to reservoirs without regard to the proximity of the intake. Under these circumstances, the dosage of carbon is usually kept at a minimum of say approximately 1 ppm so that the small amount of carbon that would get through would not be sufficient to constitute consumer complaints. If the first treatment is insufficient to produce palatable water, further treatments can be made at weekly intervals until the difficulty is corrected and without any serious objections from the consumer.

In the actual application of carbon, the usual practice is to apply it in slurry form. This slurry form of carbon is applied to the reservoir on much the same principle as copper sulfate. However, in the case of carbon, higher dosages should be applied in the deeper areas so that the carbon concentration in the water is distributed as uniformly as possible, throughout the entire depth at points varying in depth.

Preparing the carbon slurry can constitute a problem unless proper equipment is available. An excellent method was worked out by Howard E. Bailey and James B. Studley for applying carbon to a reservoir at Pembroke, Mass. (See "Activated Carbon Treatment of an Open Reservoir", *Water & Sewage Works*, page 21, June 1947). In this particular case, arrangements were made to prepare a carbon slurry on the shore of the pond. This slurry was then piped to the water's edge where the boat could come in for charging. A drum in the boat was used to hold the carbon slurry from which it was discharged to the reservoir. Complete details are described in the article.

Another procedure was utilized by Fred Luthy of Orange, New Jersey. A boat was equipped with a gasoline motor and pump, and a 50 gal steel drum for the carbon slurry. Bags of carbon were loaded aboard the boat for wetting. The pump served to supply water to the drum where the carbon slurry was prepared, and the pump also served to force the carbon slurry under pressure through a hose for distribution to the surface of the reservoir. Complete details of this arrangement are included in an article entitled, "Powdered Activated Carbon Application to Orange Reservoir"—September, 1950 issue *Taste and Odor Control Journal*.

Based on the small concentrations of carbon utilized thus far in reservoir applications with successful results, there seems reason to believe that this method of treatment constitutes a very efficient procedure. Generally speaking, dosages used are in

the very low ranges normally used in water treatment plants. Yet, the production of a palatable water from a very severe odor condition has been the result very consistently. There is also the possibility that the carbon which settles out at the bottom of the reservoir can still accomplish beneficial results. The carbon will still have some reserve capacity for odor adsorption, and it may act toward stabilizing any decomposition odors which might normally develop at the reservoir bottom.

Blackout of Algae

In addition to foods normally present in water, algae requires sunlight and suitable temperatures for propagation. The fact that activated carbon gives a dark appearance to water was considered as a possibility for eliminating the sunlight. In the application of activated carbon for this purpose, the carbon is thoroughly wet and applied as a slurry to the entire surface of the body of water to be treated. For successful results, application is made once or twice each day during periods favorable to algae growths. Thus application is usually limited to the summer months and also only to days of prolonged sunlight. Naturally, during cloudy days, carbon application is not necessary.

It remained for Hartung and Lischer of the St. Louis County Water Department, St. Louis, Missouri, to determine the necessary carbon dosage to treat a particular water surface. Based on their studies, it was found that a dosage of approximately a quarter of a pound of carbon would successfully black out a water surface of 1,000 sq ft. Thus it must be realized that the dosage necessary for carbon blackout is usually far below that necessary for accomplishing taste and odor control. However, if carbon is necessary for correction of odors, the amount used for algae blackout would automatically reduce the quantity of carbon necessary for eliminating odor conditions.

Studies in the field have shown activated carbon to be the most universally successful answer to taste and odor problems. Some reported failures have been due to improper point of application or an attempt to accomplish results with too small a dosage. It is safe to state that practically all odors can be reduced to a palatable level with activated carbon if a sufficient quantity is used at the proper point of application.

Prof. J. D. Eye Moves to Univ. of Cincinnati

J. D. Eye sanitary engineering expert of Blacksburg, Va. has been appointed associate professor of civil engineering in the University of Cincinnati College of Engineering effective Sept. 1.

Prof. Eye is a former associate professor of sanitary engineering of Virginia Polytechnic Institute, Blacksburg, where he directed the graduate program in sanitary engineering. His work at the Univ. of Cincinnati will be in the field of applied hydrology and sanitary engineering and will include liaison between the College of Engineering, Kettering Laboratory, U. S. Public Health Sanitary Engineering Center, and the Ohio River Valley Sanitary Commission. Mr. Eye has conducted research projects and surveys of water supplies and wastes problems both for industry and the United States Public Health Service. Included was a special study of the applicability of the membrane filter for the examination of isolated water supplies.

Findings of Prof. Eye's work have been published by the Virginia Engineering Experiment Station and "Water and Sewage Works" magazine. Besides his teaching experience at VPI, he taught courses in sanitary engineering at the University of Southern California.

A native of Franklin, W. Va., Mr. Eye is a graduate of Virginia Polytechnic Institute. He received a B. S. degree in civil engineering in 1948 and a M. S. degree in sanitary engineering in 1949.

He is a member of the American Society of Civil Engineers, National Society of Professional Engineers, American Society for Engineering Education, American Water Works Association, American Public Health Association, Federation of Sewage and Industrial Wastes Association, Chi Epsilon Honorary Fraternity and Phi Kappa Phi Honorary Society.

Emil Jensen Elected Vice-President of FS&IWA

The election of Emil C. Jensen, Chief of the Division of Engineering and Sanitation of the Department of Health of the State of Washington, to the office of Vice-President of the Federation of Sewage and Industrial Wastes Associations has been announced by Ralph E. Fuhrman, Executive Secretary of the Federation.

Mr. Jensen was elected to the Vice-Presidency of the Federation by a special letter ballot of the Federation Election Committee to fill the unexpired term of John W. Cunningham, Consulting Engineer of Portland, Oregon, who resigned his office for reasons of personal health and responsibilities.

Mr. Jensen is a registered Professional Engineer. He received a B. S. degree in Civil Engineering from the Univ. of Washington in 1936 and a M. S. degree in Engineering from Harvard Univ. in 1938. From 1938 through 1941 he served as Sanitary Engineer of the Yakima County Health Dept. in Washington. In 1941 he became a District Sanitary Engineer for the Washington State Dept. of Health. In 1945 he became Chief of the Division of Engineering.

Mr. Jensen served the Pacific Northwest Sewage and Industrial Wastes Ass'n as President in 1952, and as a National Director since 1953, and received the Federation's Bedell Award in 1955 for outstanding service to his association.

A resident of Seattle, Wash. Mr. Jensen is married and has three children.

Vacuum Filtration of Raw Sludge

(A Correction)

In our July 1956 issue appeared an article under the title "Vacuum Filtration of Raw Sludge" by Kerwin L. Mick and Scott E. Linesly of the Minneapolis-St. Paul Sanitary District.

The authors wish to correct the foot-note to Table 3 and two column headings in Table 4. Where the amounts of ferric iron coagulant are recorded as %Fe (iron) in both instances the amounts shown actually are in terms of % Ferric Chloride ($FeCl_3$). In short the figures reported are correct—the heading (Fe) is in error. Interested readers please change these headings to read %Fe Cl_3.

On page 321 there appears a typographical error. It is stated that the Sanitary District staff developed the new method of filter washing in 1955. The year is in error; it should have been 1945.

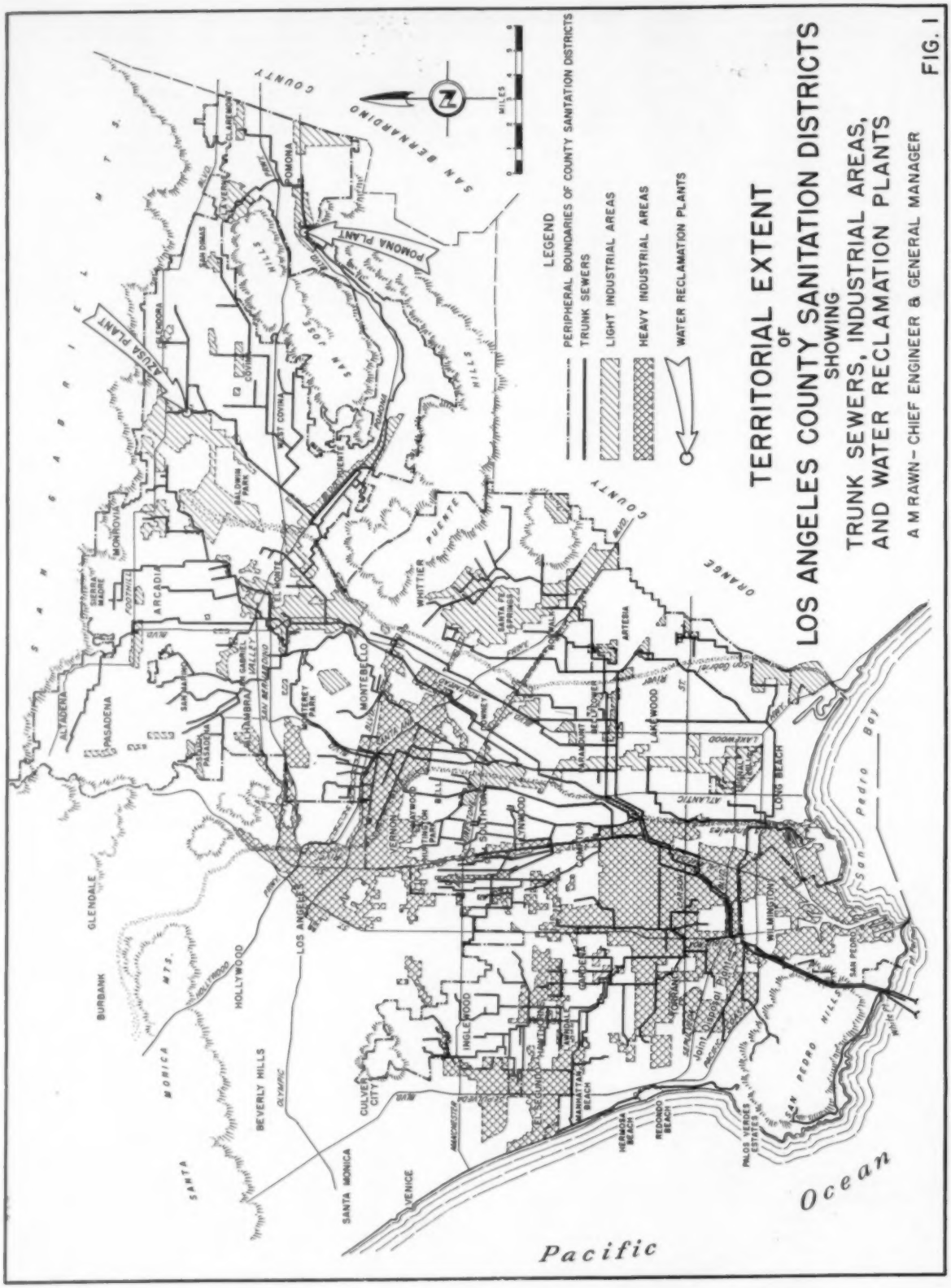


Fig. 1—Los Angeles County Sanitation Districts, showing locations of trunk sewers and water reclamation plants.

Sewage--A Raw Water Supply

Wherein, planned water reclamation plants do what nature has done for generations and cost less to build and operate than sewage treatment plants.

by A. M. RAWN* and F. R. BOWERMAN

The senior author is Chief Engineer and General Manager of the Los Angeles County Sanitation Districts, Los Angeles, Calif. Mr. Bowerman is Division Engineer in charge of experimental research and development for the County Sanitation Districts.

IN NATURE the conversion of the used water supply of a community to a potable supply of pristine purity is a common phenomenon documented under the general title of hydrology.

Evaporation from highly saline water bodies such as the ocean, with resulting rainfall and subsequent replenishment of rivers, lakes and underground supplies, testifies daily to the ease with which natural processes make useful those waters which man finds unpalatable and useless for agricultural and most industrial purposes. Not so readily appreciated is man's work in converting wasted waters for further utility, through application of certain biochemical processes commonly used in the treatment and disposal of sewage. Yet there are no apparent reasons, other than esthetic, which preclude the utilization of domestic sewage as a valuable source of raw water supply.

The transformation from water to sewage occurs through multitudinous uses, each contributing its own particular constituents: organic, inorganic, soluble, insoluble, floatable, colloidal or settleable. To reverse the transformation is more difficult, but reversed it can be; and is, in many towns and cities throughout the United States and the rest of the world. With acceptance of the basic principle that water is not consumed through use as a conveying medium for sewage solids and industrial wastes, it becomes relatively simple to establish principles for guiding the re-use of such waters. Paramount to all other considerations must be matters of health and esthetics; secondarily, the utility of the reclaimed water as determined by its constituent properties and the uses to which it may be placed; finally, the economic value of the water as related to alternative supplies.

Planned Water Reclamation

It is essential at this point of the discussion to differentiate between water reclamation as a planned venture, in contrast to the use of sewage effluent as a means of disposal. Certain water reclamation systems, almost classical in the literature, demonstrate this difference in concept. The historical sewage treatment water reclamation plant is that of Grand Canyon, Arizona; Golden Gate Park in San Francisco is served by water reclamation plants built specifically to re-use the water in irrigating lawns and providing decorative lakes; the sewage treatment works of Baltimore, Md., for several years has provided a raw water supply for Bethlehem Steel Co.; numerous industrial operations in the arid southwest depend almost entirely upon re-use of sewage and industrial wastes for the continuation of mining, oil refining and manufacturing processes. Contrasted with these are incidental uses, notably where effluent from sewage treatment plants is used in farming as a means of effecting final disposal.

Metropolitan centers by their very nature result in extensive and complete systems of trunk sewers which require more careful maintenance and operation than simple community sewerage systems which are frequently associated with sewer farms. In large urban areas any major interruption of sewerage service results in serious damage to property, poses health problems, and creates nuisances; the bypassing of sewage flow or lessened efficiency of sewage treatment, due to emergency conditions, certainly creates more serious problems in populated areas than would a similar upset in a suburban area or farm community. Reclaiming waste water in an urban community calls for finesse in planning and operation and almost complete security against mishap, requirements which clearly indicate the necessity that water reclamation in such areas be predicated upon having available an adequate sewage collection and disposal system. The authors will attempt to describe such a system and indicate the simplification and economy afforded by superposing a water reclamation system on an already existing sewerage system.

Effect of Reclamation on Plant Location

Figure 1 shows the territorial extent of the Los Angeles County Sanitation Districts, excepting two desert communities in the Antelope Valley. Principal trunk sewers are shown, as well as locations of some 45 cities served by the Districts' system. It should be noted that the Districts' sewage system commences high up on a flood plain at the base of the Sierra Madre Mountains and drains seaward towards the Pacific Ocean. Most of the foothill communities are so-called "bedroom communities," housing those working in industrial or commercial areas; and, it is only since the extention of the Districts' trunk sewer system into the San Gabriel Valley in the northeastern part of Los Angeles County that industrial expansion has been effected in that area. The result of this natural separation of industrial and residential areas is that upstream sewage is characteristically free of mineralized wastes associated with industry, while the flow which cannot be disassociated from industrial waste in downstream trunk sewers may have little or no utility as reclaimed

*Editorial Associate of WATER & SEWAGE WORKS.

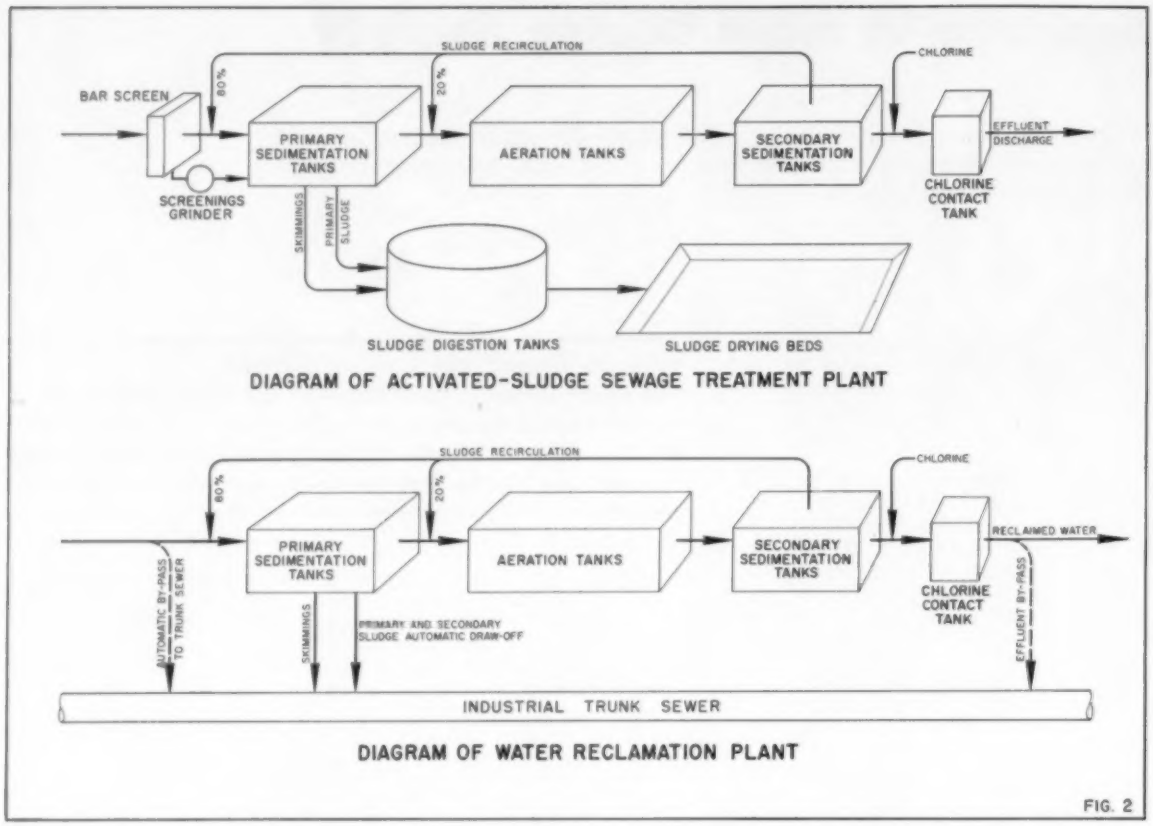


Fig. 2—Diagrams comparing a sewage treatment plant with a water reclamation plant.

water. It is estimated that in the Los Angeles County Sanitation Districts about 50 mgd, about 25% of the waste water, can be reclaimed for reuse.

Shown on Figure 1 as hatched areas, are light and heavy industrial centers; light industry is here limited to assembly processes, whereas, heavy industry is here used to describe those processes in which raw materials are manufactured into goods. Typical heavy industries in the Los Angeles County Sanitation Districts are oil refineries, chemical plants, steel mills and certain heavy fabrication industries such as plating works, aircraft and automobile assembly plants. These areas are shown in relationship to the overall sewerage system to demonstrate a relationship apparently quite common to many large sewerage systems in that heavy industries tend to locate on the downstream trunk sewers of the system to insure adequate capacity for the large volume of industrial waste flow that such processes customarily discharge. Other factors are undoubtedly significant, but this one, by itself, tends to discourage heavy industry from locating in the upstream areas which are served by the smaller diameter trunk sewers. By circumstance, the need for reclaimed waters is greatest in the upstream alluvial valleys, whereas, industrial uses for reclaimed sewage will be greatest in the lower portions of the sewerage system. In some instances, trunk sewers may have to be built in upstream areas for the express purpose of collecting industrial wastes, thereby avoiding an adverse effect on domestic sewage to be reclaimed for reuse.

The extension of the Districts' trunk sewer system into the northern and easterly sections of Los Angeles County resulted in the encompassing of four existing sewage treatment plants. Although two of these, near the cities of San Gabriel and Whittier, were abandoned several years back for seeming reasons of economy, hindsight suggests that abandonment of these plants may have been premature. Two other plants at Azusa and Pomona have been retained as dual purpose plants, (a) for sewage treatment, (b) for by-product recovery, and are presently being operated by Sanitation Districts 21 and 22. Comparisons between operating procedures, solely as sewage treatment works or as water reclamation plants, reveal the simplicity and economy associated with planned water reclamation plants. A brief economic summary of the Azusa and Pomona plants will be presented later in this paper.

Effects on Design of Trunk Sewers and Sewage Treatment Plants

It has been stated as basic to the authors' philosophy of water reclamation, that the safe and sanitary disposal of sewage is paramount to all other considerations and that water reclamation must, of necessity, be subservient to this prime objective. There are certain mitigating factors in superposing water reclamation on a sewerage system which result in economy in the construction of trunk sewers and sewage disposal works. For illustration, consider the capacity requirements needed immediately downstream from a water reclamation plant, sufficient to permit the complete bypassing of the contents of

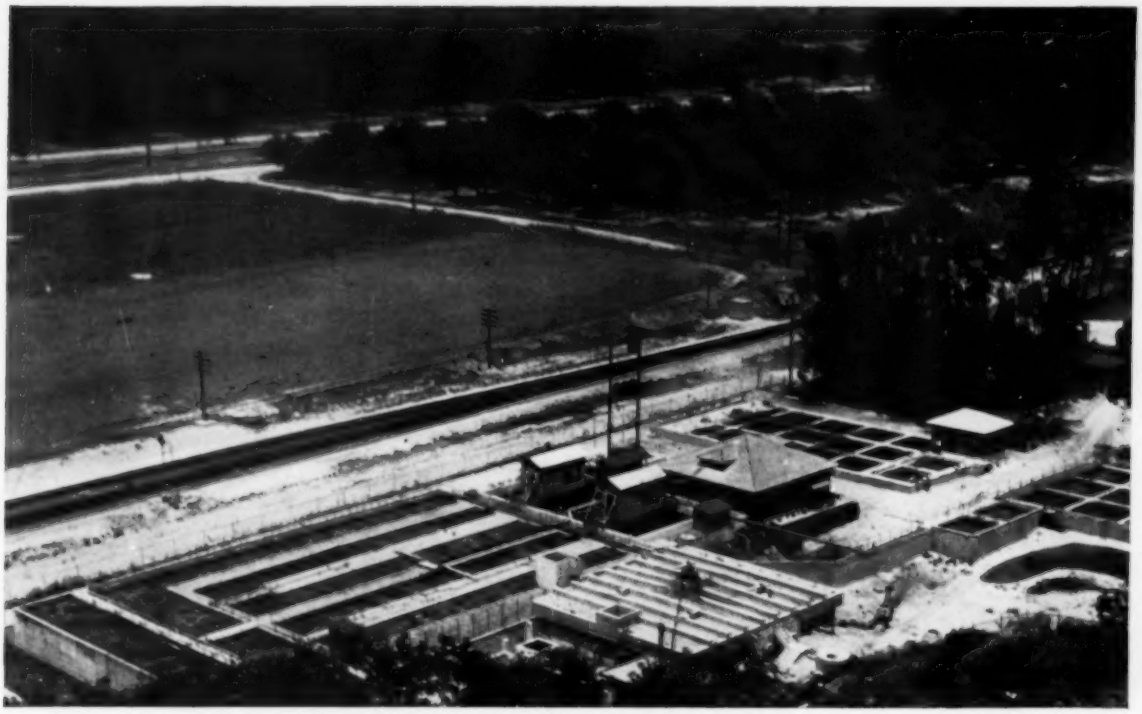


Fig. 3—Water Reclamation Plant at Pomona, Calif.
An activated sludge plant rated at 3.5 mgd. Chlorinated effluent is sold for growing walnuts and citrus and spray irrigation of pasture land.

the water reclamation plant as a result of biochemical upset or mechanical failure. At first thought, this might suggest that the trunk sewer capacity must need be designed for the peak flow tributary to the water reclamation plant, but further consideration shows that this is not necessarily so. The storage capacity of primary and secondary sedimentation tanks, as well as aeration tanks in the case of an activated sludge plant, can be utilized to considerably reduce the peak rate of discharge to to downstream sewer. In effect, the water reclamation plant can be used as a balancing reservoir to reduce peak flow requirements. This line of reasoning is more nearly foolproof if flow to and from the water reclamation plant is effected through gravity; but even where influent or effluent pumps are needed to fill or empty the plant, it is considered good practice to provide standby power in the event of utility power failure so the system is again very nearly foolproof. The use of water reclamation plants as balancing reservoirs is obviously of more value on upstream trunk sewers where the ratio of peak to average flow may run as high as 200%, whereas, leveling influences in downstream trunk sewers reduce the ratio of peak to average to somewhere more nearly 150%.

Design Economy Factor

A factor which can exert an influence toward economy in the design of the disposal works serving the entire sewerage system is a reduction in capacity requirements for sewage treatment which results from the establishing of several water reclamation plants upstream in the system. Assuming that in an existing sewerage system one establishes a single water reclamation plant, it seems clearly indicated that the downstream disposal works must assume the responsibility for handling the full 24-hour capacity of the water reclamation plant in the event of its failure; however, the establishing of several water reclamation plants in the same system suggests that little likelihood exists of simultaneous failure of the several plants, therefore, the disposal works may be designed to handle the total sewage flow reaching the disposal works in the event only *one* of the reclamation plants becomes inoperative. The decision as to the design disposal capacity is a matter for judgment and would undoubtedly be influenced by the severity of adverse effects which would be created at the disposal works by disproportionate flows. Where large water reclamation plants are to be constructed, it is deemed particularly appropriate that the plant be constructed in multiple units so that the disrupting of any single unit will not materially affect the total plant operation.

Effect on Design of Water Reclamation Plants

A water reclamation plant which is to be integrated into a sewerage system can be a much simpler, less costly structure than were it to be designed as a sewage treatment plant in itself. Large savings are realized through elimination of all sludge handling and process facilities. Primary, secondary, and activated sludge, as well as scum, may be returned to the main sewer flow by gravity, and the expensive features ordinarily required for solids handling and disposal in the true sewage treatment plant are supplanted in the water reclamation plant by return to the sewer through time operated valved connections.

If the flow into the water reclamation plant is by gravity and solids

Fig. 4—Water Reclamation Plant at Azusa, Calif.

Effluent from trickling filter plant is chlorinated and discharged to spreading basin in foreground, from which the water infiltrates into the ground water reservoirs for subsequent withdrawal through well pumping.

returned to the sewer in the same manner, bar screening with its accompanying structures and housing may be eliminated. To do this it may be required that advantage be taken of steep grades or drop manholes in choosing the location of the water reclamation plant. This is, however, usually a possibility in the upper reaches of a large system.

With the elimination of all sludge processing facilities and bar screening, the plant is reduced to fairly simple elements which are, of course, reflected in a reduced construction, maintenance and operating costs. Figure 2 shows schematic comparisons between a sewage treatment plant and water reclamation plant, both utilizing the activated sludge process.

Taking a look at operation and maintenance of such works, one finds these functions not only reduced to a fair degree of simplicity, but also so thoroughly buffered by the plant's ability to shut off or continue operation at almost a moment's notice as to guarantee a thoroughly satisfactory end product in the form of plant effluent without recourse to excessive technical knowledge or, indeed, very much operation labor of any kind.

The reduction in operation cost is ably demonstrated in the two small plants under discussion. As indicated by cost data Table 1, the services of six employees were required to operate the Pomona plant (Figure 3) while it functioned as a sewage treatment plant for the final disposal of sewage from the cities which it served. With the advent of the main District trunk sewer passing the plant site and from which was drawn the raw water supply, plant personnel was reduced to one man operating 48 hours a week and living in suitable quarters on the plant premises, supplemented by one relief operator one day each week. Some adjustments had necessarily to be made in the plant's mechanical equipment in order that the facilities could be set to operate automatically on a time schedule, but the principal saving is what has been sheared off and done away with and the resultant ease with which the remainder of the plant can be operated. It is quite impossible to conceive of a crisis developing in

TABLE I

Comparative Costs per Million Gallons

	Operated as—	Operation and Maintenance	Amortization	Total Cost
Azusa Plant (450,000 gpd trickling filter plant)	A sewage disposal plant	$99	$53	$152
	A water reclamation plant	$36	$40	$76
Pomona Plant (3,500,000 gpd activated sludge plant)	A sewage disposal plant	$50	$35	$85
	A water reclamation plant	$27	$26	$53

The feasibility of any water reclamation project depends upon economic comparisons with alternative sources of water supply. Unless a favorable economic savings is indicated, little or no justification exists for water reclamation. The above figures indicate that in the Los Angeles Metropolitan Area material savings can be realized thru reclamation of used water.

the Pomona plant as a result of any influence that might be brought to bear upon it. The very worst that can happen is to shut down the plant, close the inlet valves, open the outlet valves to the main sewer and start up again when it is time to do so.

The same situation holds at the small Azusa plant (Fig. 4) where only two hours per day of one man's time are required for operation. From these two operating examples, the District forces hope to extrapolate into a series of small plants having many times the capacity of those under discussion.

Summary and Conclusion

In metropolitan areas the positive assurance of safe sewage disposal is a paramount consideration; water reclamation must be so integrated with the disposal system as to present no hazards to health or property. Once afforded a sewerage system which will effect disposal under almost any predictable circumstance, water reclamation may be superposed on such a system with confidence and economy. Operational savings largely result from the fact that the water reclamation plant is operated solely on the principle that the sewage flowing past the plant in the trunk sewer is a raw water source; as much or as little as desired may be removed, treated, and restored to use, with the sewage skimmings and sludge returned to the trunk sewer for downstream treatment and disposal.

"Floating Waterworks"

Helps Solve Desert Water Supply Problems Supply Problems

A "Floating Waterworks", built by a British firm, has just gone into service in Iraq. It was designed and built to supply clean and safe drinking water to remote areas of the country where villagers have, in the past, had to rely on the raw waters of rivers and canals.

The pontooned water plant was built in the Wolverhampton works of Marston Excelsior Ltd., a subsidiary company of Imperial Chmeical Industries Ltd., from an original specification by Mr. George Smethurst, a Baghdad water engineer who has cooperated with UNESCO in seeking to solve the vital hygienic problem of water supply in Iraq.

The first prototype of the "waterworks" was put into operation in Iraq a year ago. As a result of working experience, various improvements were made. The latest model recently underwent river tests in England and has now been shipped to Iraq. Construction of further similar models is planned.

Extensive use of raw river water in Iraq often brings fever. Underground water is almost universally present but this generally is grossly polluted. Mr. Smethurst first sought to solve the problem in the Dujaila area, where his first purification plant, a static one, supplied 2,200 Imperial gallons of pure water per hour to the surrounding countryside. The incidence of waterborne disease in the area fell by 40% in the eighteen months after its installation.

Encouraged by this success efforts were made to overcome a particularly difficult local problem. The rivers in Iraq are subject to flooding and rise and fall annually through a vertical range of as much as 40 feet. Marston Excelsior Ltd. were asked to design a waterworks capable of floating. The performance of this first model proved extremely satisfactory and the success of the project has led them to build the present improved and modified version of the plant, here pictured, which is now going into operation.

The plant comprises a series of welded units bolted together to make up a vessel, on top of which the pumping and treatment plant is mounted. The unit is moored to the river bank by an arm pivoted to allow a rise or fall according to river level. This arm also serves as an access gangway and carries the water pipe ashore and the electric cable aboard. The elements of a complete waterworks are present, sedimentation tanks, filter, chemical feeders and pumps, but in this case the high level tank is replaced by a well known waterworks device called a pneumatic booster in which water is stored at high pressure against a cushion of compressed air.

Buoyancy tanks ensure that it will not sink under any conditions of handling or negligence.

In operation the whole works is automatically activated by a pressure switch. When the water pressure falls, because of use in the village, to a preselected limit, the switch starts the pump which draws water from the pure water tank. This produces a state of hydraulic unbalance in the treatment plant, inducing a flow of river water through the sedimentation tanks and filter.

The project does not depend entirely on electricity being available. The plant can be driven by alternative prime movers and a number of solutions have already been worked out.

The output of the floating plant is at a rate of about 1,200 gallons per hour against a head of 80 ft. with a maximum rate of 2,400 gallons per hour against a similar head—which is sufficient for the daily needs of villages of up to 1,500 people or even more. The cycle of operations is completely automatic.

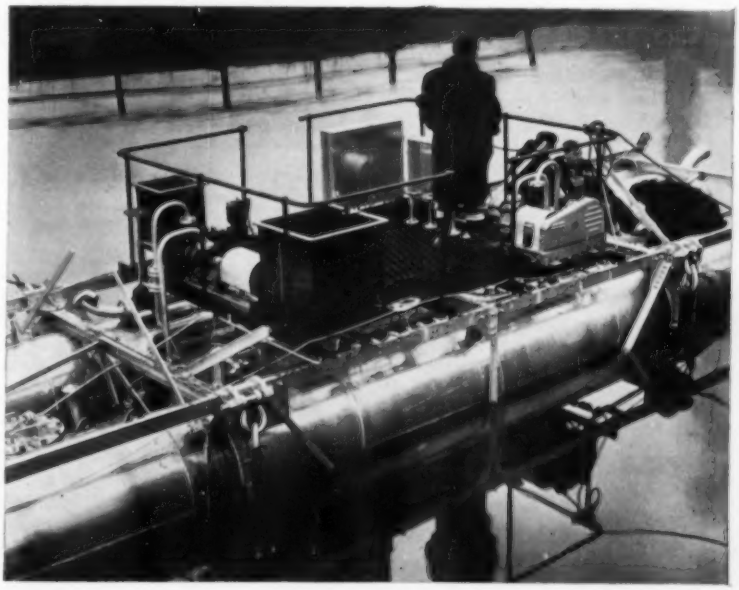


Fig. 1—STREAM GAGING station—East Meadowbrook, L. I.

Conservation of Ground Water*

Practices used on Long Island, New York

by W. FRED WELSCH

Mr. Welsch is Senior Engineer in the Nassau County Dept. of Public Works, Mineola, Long Island, N. Y. In this article he describes the system of recharge basins and diffusion wells used in Nassau County.

LONG ISLAND, a part of the State of New York, is the largest island on the Atlantic coast of the United States and is entirely surrounded by tidal salt water. It is about 120 miles long with a maximum width of 23 miles. It is separated from the mainland of New York and Connecticut by the East River and Long Island Sound.

Long Island contains four counties: Kings (Brooklyn) and Queens County, which are part of the City of New York are located at the western end; Nassau and Suffolk Counties comprise the easterly two-thirds of the island.

In 1950 the four Long Island counties had a population of 5,237,918. Present estimated population is more than six million which is more than 36 per cent of the population of the State of New York. Recent rapid growth is evidenced by estimates of the Long Island Lighting Co. which placed the population of Nassau County on Jan. 1, 1954 at 966,841, and Suffolk County at 379,573. These numbers represent respective increases of 43.7 and 37.5 per cent in three years following the 1950 census.

Nassau County, with an area of 275 square miles, has developed into a suburban community, metropolitan in character, with both small and large industries. Many large estates and farm lands are rapidly being developed into residential communities.

Suffolk County, with an area of 920 square miles, has many suburban areas, farms and estates. Its present industrial development is relatively small.

Excluding the western area, which is within the limits of the City of New York, Long Island with a land area of 1365 square miles is dependent upon an annual rainfall of about forty-two inches for its water supply. As streets are paved, buildings erected and sewers installed, the percentage of rainfall that is absorbed into the ground decreases, thus reducing the amount available for water supply.

Use of Ground-Water

The underground beds on Long Island are of primary importance as sources of public water supply, and public water supply systems are the

* A paper presented before the New Jersey Sect. AWWA and released for publication in *Water & Sewage Works*

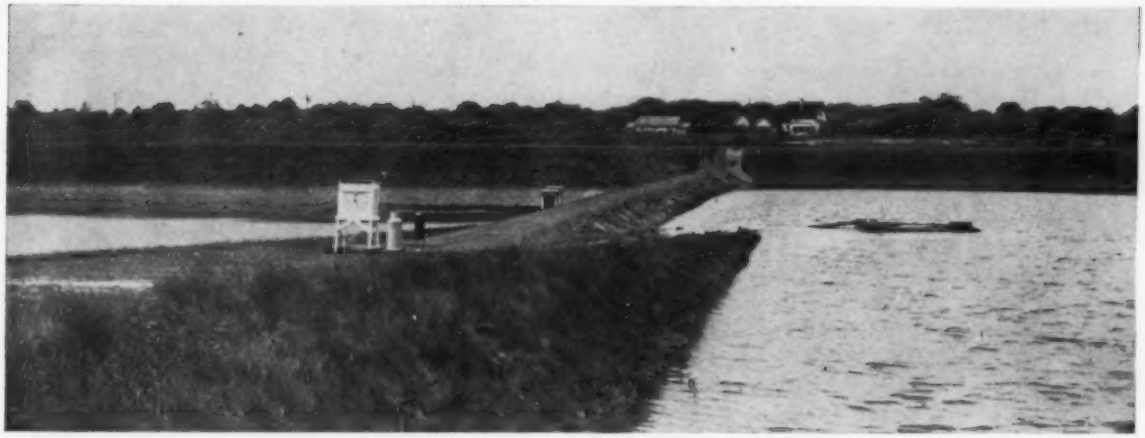


Fig. 2—RECHARGE basin—Rockaway Road, Garden City, L. I.

largest distributors of that water. In Kings and Queens Counties part of the supply for domestic consumption, with the exception of a few scattered wells, is obtained from the public water supply well systems but about four-fifths of the public supply used in Kings and Queens Counties is secured from the New York City upstate collection system.

In Nassau County a small proportion of the domestic and industrial supply is secured from private industrial wells. In Nassau County there are 50 public water supply systems, consisting of Villages, Water Districts and private companies. Because of the more rural nature of Suffolk County, a somewhat greater proportion of domestic supply comes from a large number of small private wells. In Suffolk County there are 15 municipally owned systems, 12 systems under control of the Suffolk County Water Authority, and 60 privately owned systems. Kings and Queens Counties have a large industrial use of water, but agricultural use in these counties is negligible. Nassau County has nearly completed its transition from an agricultural to a residential and industrial area. Suffolk County has not yet felt the impact of such a transition, and the farm land is more extensively cultivated. The practice of irrigation by the use of well water has increased in Suffolk County.

The Ridgewood water supply system of the City of New York, which extends east from the borough limits of the City of New York to the Suffolk County line along the South Shore, consists of wells, ponds, and an infiltration gallery in Nassau County, and are used only during times of emergency to supply Brooklyn, the Rockaways and part of Queens County.

The average daily pumpage of water on Long Island during 1949, according to the reports of the New York State Water Power and Control Commission, was 271 mgd, of which 61 mgd was industrial, 190 mgd was private and public, and 20 mgd was agricultural.

In comparison, the average daily pumpage in 1954, according to the same authority, was 312 mgd, of which 77.7 mgd was industrial, 217 mgd was private and public, and 17.4 mgd was agricultural. These increases in the average daily pumpage amount to approximately 15 per cent in five years.

Topography

The topography of the Island is reasonably uniform. The north shore is somewhat abrupt, frequently rising to hills a few hundred feet in height. From the south shore the land rises gently to the backbone of the Island. The southerly side of the Island consists of plains sloping gently toward the Atlantic Ocean. The most prominent features of the surface topography are two glacial moraines. One extends from Montauk Point diagonally across the Island and along the north shore of Queens County, and the other in a southwesterly direction from the main ridge in Queens and Brooklyn. The two cross near Lake Success. Elevations of these ridges in several locations are more than 300 feet above sea level.

Natural surface drainage of Long Island takes place through the action of many small surface streams. (Fig. 1) Those along the northerly side are of short length, narrow width and steep slopes. Those along the southerly side are of somewhat greater length, equally narrow width but less steep slopes. Many of the streams flow through small natural and artificial lakes.

Geology and Hydrology

Long Island is underlain by bed rock mainly of schists and gneisses, which crops out only in a small area in the northwesterly part of Queens County. The bed rock slopes gently about sixty-four feet to the mile in a general southeasterly direction to depths of about 1500 feet on the south shore and to 2000 feet at the easterly end of the Island. There are a number of depressions in the land surface in the northerly section, called kettle holes. Varying thicknesses of impervious material underly the ground surface above the shallow groundwater table form perched water tables which were made during the Glacial Age.

The material between the rock floor and the surface of the Island consists of successive layers of sand and gravel aquifers, interspersed with lenses of clay. These water bearing formations have considerable magnitude, and all hydraulically interconnected. Here rain water and melted snow percolate through pervious subsoils into the sand and gravel aquifers to serve as underground storage reservoirs for fresh water which are drawn upon by means of shallow and deep artesian wells for utilization by public water supply systems and for private, industrial and agricultural purposes. Water-bearing formations (aquifers) in Long Island are Upper Pleistocene deposits, Jameco gravel, sands of the Magothy and Lloyd sand member which are interconnected hydraulically.[1]

Inasmuch as the ground water has relatively low temperature it is used during the summer months for cooling and air conditioning by many establishments on Long Island—theatres, restaurants, ice plants, public buildings, breweries and manufacturing plants.[2]

Fig. 2a—RECHARGE basin—Clinton Road—Garden City, L. I.

According to the opinion of Geologists and Hydraulic Engineers of the United States Geological Survey there is no foundation for the theory that fresh water flows from New England or Connecticut under Long Island Sound to Long Island.

Salt Water Intrusion

Because of the widespread occurrence of highly productive water bearing material and other favorable factors, the ground-water resources of Long Island have been used extensively for many years for industrial, public supply and agricultural purposes. Overdevelopment in the heavily industrialized and populated areas at the western end of Long Island caused a gradual decline of water levels. In 1933, it was discovered that the water table was below sea level in an area of more than 40 square miles in Brooklyn, and that sea water was moving into the area. Subsequently, all public water supply wells were abandoned in Brooklyn.

The extreme drought of the summer of 1944 caused a Lloyd well (at the Port Washington Water District near Long Island Sound and Manhasset Bay on the north shore) to be abandoned, due to salt water intrusion, and subsequent pumpage has been limited in that well field.

Control Regulations and Agencies

In 1933, the State legislature, recognized the seriousness of the situation and took steps to protect the public supplies on Long Island from further overdevelopment. A conservation law was passed placing the ground-water resources of Long Island under the jurisdiction of the New York State Water Power and Control Commission. This conservation law, as amended, states that no wells having a pump capacity in excess of 45 gallons per minute shall be drilled unless approved by the Commission. This provision does not apply to agricultural wells or fire wells with no permanent pumping equipment. All well drillers are required to be licensed on Long Island.

The Commission also requires that ground-water pumped for air conditioning, refrigeration or air cooling must be put back into the ground in an uncontaminated condition, through diffusion wells or recharge basins. Where public water supply wells have static levels above the ground surface near the shore, special devices are required to prevent waste to tide water, due to overflow when the wells are not in service.

Sewage or industrial waste disposal is not permitted within limited distances of a public water supply well. This prohibition is set by the classifications and standards for under ground water adopted by the New York State Water Pollution Control Board. Treatment of industrial wastes before discharge into the ground is required by State and local Health Departments.[3] Water discharged from air conditioning systems is not permitted to be discharged into sanitary sewers.[4]

Since 1932 Nassau County has been engaged in the investigation of ground-water resources on Long Island, and since 1936 in the investigation of surface water resources in cooperation with the United States Geological Survey and the New York State Water Power and Control Commission.

We have a grid system layout of observation wells throughout the County to determine the fluctuation of water levels and also outpost observation wells to determine the Chloride content and movement of the salt water front; also, we maintain stream gaging stations (Fig. 1) and a meteorological observation station. Observation wells are also located in Kings, Queens and Suffolk Counties.

Artificial Recharge Basins

The County of Nassau, through its Engineering Department, under the direction of John C. Guibert, Commissioner of Public Works, and the Board of Supervisors, has been cognizant of the diminishing water supply for 20 years. In order to provide for its future needs and replenish its ground-water storage, the County has been engaged, since 1935, in the construction of large acreage impounding and ground-water artificial recharge basins. These basins are used to put storm water back into the ground through the pervious sand and gravel at various locations where feasible through the middle section of the County. This area, in which recharge is feasible consists of about 100 sq. mi. These recharge efforts have resulted in saving millions of gallons of storm water which otherwise would be wasted into tide water. The long range master comprehensive drainage plan[5] was prepared under the author's direction for the Nassau County Sanitation Commission, and in 1936 was adopted by the Board of Supervisors. At the present time more than 300 artificial recharge basins are under County control, and others under State, Town or Village control.

A large number of similar recharge basins have been constructed in Suffolk County. There are no recharge basins in Queens or Brooklyn, but about forty years ago, at the Forest Stream Pumping Station, the New York City Water Department operated a number of prepared areas into which the flow of Forest Stream was diverted.

The following is a brief description of our experiences in the design, con-

struction and maintenance of the impounding (storage) and artificial recharge basins in Nassau County.

Step No. 1 consisted of drilling test borings with a well drilling rig at the proposed site to a depth of at least 20 feet below the lowest static ground-water level. Undisturbed samples of subsurface materials encountered were obtained by means of a soil sampler, split steel tube type, made with a trap at the bottom of the sleeve above the cutting edge of the shoe.

Step No. 2 was to make a mechanical analysis of the materials to determine the hydraulic characteristics, i.e. permeability, capillarity and frictional resistance, etc. From these borings the character, elevation, thickness and extent of the unconsolidated materials were determined.

Step No. 3 consisted of excavating the basin to the desired size and depth. Clay lenses encountered in excavation operations during construction were removed; when possible these lenses were avoided.

On several projects, the recharge basins are divided into two sections; one is an impounding basin from which water flow is regulated by manual control shear gates at different levels so that the volume to the recharge basin may be regulated. The impounding or detention basin section (about one-half of the basin area) allows the water to settle its silt load before it passes into the recharge basin section where the water is returned to the aquifers. These detention sections also permit the removal of any surface oils by skimming. These oils usually originate in storm water from roadways recently oiled. Ramps are provided on one side of each basin so that maintenance trucks and equipment may have access to the bottom and side slopes.

One of the largest recharge basins is located at Rockaway Road and Old Country Road in Garden City. (Fig. 2). The length is 648 feet, width 402 feet and depth 11 feet. The area drained is 2080 acres, and the basin capacity of 3,685,000 cubic feet has a floor area of 224,900 square feet. The smaller basins have capacities of 60,000 cubic feet or less. For optimum results the bottoms of the recharge basins should, where practicable, be from 7 to 10 ft. above the static ground-water level.

Operation of Recharge Basins

Estimates were made on the rate of seepage, based upon heads varying from 0.5 to 9 ft in depth; average results indicated a recharge rate of 23 gal per sq ft per 24 hr. With a safety factor of two for design, a design rate of 11 gal per sq ft per day was used, or approximately 0.5 mil gal per acre per day.

A system of long trunk storm sewers would have carried great quantities of this valuable resource to tide water and thereby removed it from areas whose water supply it was necessary to replenish. The system of short lines and seepage basins, therefore, in addition to certain economies of construction, has provided a means of water conservation almost as effective as natural conditions of the area. By this system the surface water runoff during a storm is carried through relatively short storm sewer lines to artificial storage and seepage basins.

In order to obtain more accurate data, intensive hydrologic studies of infiltration and evaporation at artificial impounding and recharge basins began in May 1949 by the United States Geological Survey, Ground and Surface Water Branches in cooperation with Nassau County. A small test basin was constructed within the south portion of the Rockaway Road recharge basin in Garden City. Flow into this small area of 40 by 50 feet is controlled by the operation of a sluice gate and is measured by a steel wier whose discharge is established by current meter measurements. These measurements are made in a flume built from the mouth of a thirty inch discharge pipe which carries water from the impounding basin.

The tests made to date in the experimental basin show seepage capacities of 40 and 400 gallons a square foot a day at depths of about one foot. Other capacities between these two values were observed under a wide variety of conditions at all seasons of the year, but, because of the wide variance in conditions for the same month or season in different years, it is not possible at this early date to draw final conclusions regarding the performance of the testing basin for any one month or season. Tests show that the seepage capacity of the testing basin continues to be equal to or greater than that of the main seepage basin without having been scarified and after having been flooded much more frequently than the main basin since the beginning of the project. Further tests show that repeated floodings at short time intervals result in reduced seepage rates and smaller successive rises in water table elevations.

The average cost of construction of the recharge basins owned by

Fig. 3—DIFFUSION well for storm water
(View down into barrel)

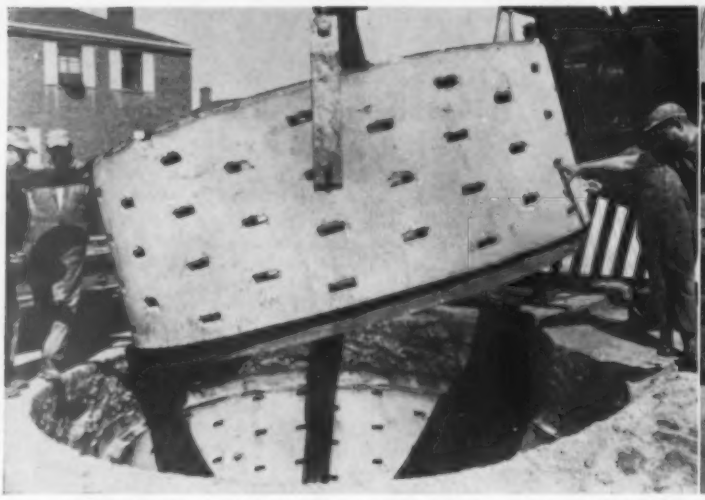


Fig. 4—SETTING pipe section in storm diffusion well

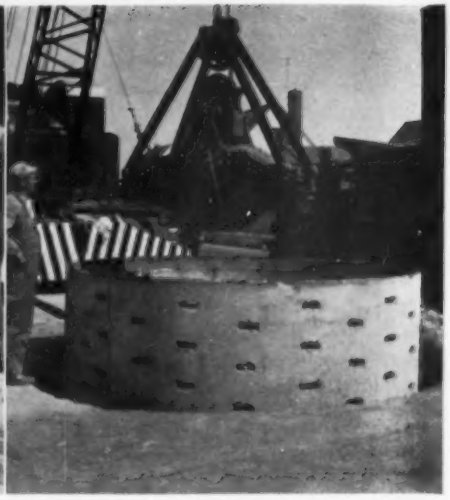


Fig. 5—CLAMMING to sink well by open caisson method of excavation

Nassau County is difficult to determine, as aid was rendered by other departments of the County to the Department of Public Works and also financial assistance was given by W. P. A.

A very rough estimate of artificial recharge through this method of replenishment in Nassau County is 40 mgd, and the estimate of discharge of sanitary sewage effluent into tidewater from the treatment plants in the County is about 38 mgd at the present time.

Maintenance of Recharge Basins

To keep seepage rates at maximum values, the basin floors are harrowed with a smooth wheel-harrow, usually twice a year. The surface penetration is two inches, with depth controlled by a hydraulic lift on the tractor. Harrowing is done when the basin floors are dry and when weed growth is small. This operation kills all weed growth and keeps the bottom at all times clean and the surface opened and porous. With the exception of the impounding basin at the inlet which receives most of the silt, there is no large amount of silt accumulated in the seepage basins. However, if this thin layer of silt is not broken up it seals the surface and will, in a short time, diminish its capacity for seepage. It was found that the harrow method with controlled depth was the best answer. Harrowing in the impounding basins is only for weed control.

Experience has shown that weed killing does not open up the surface. Some of the basins have been treated in this manner for a period of about ten years, after which, in some cases, it becomes necessary to remove the top mixture of silt and gravel and replace it with clean gravel and sand. A bulldozer and trucks are used for this purpose.

Maintenance forces consist of patrols of one foreman and five men, trucks and equipment. Each patrol maintains about 60 recharge basins.

The locations where the basins have been constructed by our Department in Nassau County have been graded, landscaped, planted and developed into park area for recreational use, with winding paths, flowering shrubs, park benches, and from an esthetic standpoint are an asset to the community.

Diffusion Wells

The storm water diffusion well (Fig. 3) is the most recently developed tool that Long Island, New York is using to return rainwater to the ground and maintain the ground-water table at an elevation that will guarantee the safety of well supplies. These probably should be termed "reverse wells" since they return water to the ground. These wells are very practical where geological formations consist of unconsolidated sand and gravel that receive storm water readily. They provide a dual purpose, supplying a means of providing drainage in areas that are difficult to drain, and conserving Long Island's only source of public water supply.

A number of storm water diffusion wells are already in operation in Nassau and Suffolk Counties and in New York City's Borough of Queens. The wells do a good job of disposing of roof and yard drainage. They also provide a ready means of draining parking fields and certain street intersections where the cost of trunk sewers would be prohibitive.

The diffusion wells consist of prefabricated, reinforced concrete pipe sections with flared openings in the barrels. (Fig. 4-5). One type of pipe section is 7½ ft in diameter and 4 ft in length; the other is 10 ft in diameter and 6 ft in length. The larger sections have 7 inch walls for depths reaching to 60 feet, and 10 in. walls for the greater depths. The flared openings permit the water to seep into the sand and gravel around the perimeter. Sections are fastened together in six places through the slotted openings with vertical steel straps and double straps for depths over 60 feet. The bottom section, which is open for seepage, has a steel cutting edge to help sink the well by means of the open caisson method of excavation. The reinforced concrete cover slab has a manhole opening with a castiron frame and cover to provide access for cleaning and removal of silt in order to maintain successful performance and efficiency in operation.

On large projects, test boring should be made with a well drilling rig at the proposed site to a depth of at least 20 feet below the static ground-water level, to ascertain the nature of the subsurface materials in order to be assured of satisfactory seepage conditions. Tests have indicated infiltration rates up to 440 gal per sq ft of seepage area per day. The wells work best when the bottom of the well is not less than 6 ft below the highest ground-water level.

The pipe drainage system discharging storm water into the diffu-

sion wells has combination street catch basins with open bottoms, permitting heavy silt to settle out before storm water enters the diffusion well. These basins require cleaning periodically. Slotted reinforced concrete pipe is used in the storm drain lines.

Cooling and Air-Conditioning

The Water Power and Control Commission has usually required that water pumped from new cooling and air-conditioning wells must be returned to the same aquifer in an uncontaminated condition through an approved structure such as a diffusion well at least 100 ft distant from the supply well.[6] This type of diffusion well has a capacity varying from 100 to more than 550 gpm. The actual area of the diffusion well screen must be at least 25 per cent greater than that of the supply well, and the diffuser's effective area must be at least 100 per cent greater than that of the supply well whose product is being diffused.

Not all localities are suitable for installing diffusion wells for cooling and air-conditioning waters. Consideration should be given to diffusion wells causing temperature rise in proximity to nearby air-conditioning wells.

Records compiled by the New York State Water Power and Control Commission indicate that during 1954 more than 40 mgd of well water was pumped and returned to the ground in the four counties through diffusion wells or other structures. In 1936 about 5.4 mgd was returned to the ground. Approximately 715 diffusion wells were in use as of Jan. 1, 1954.

Summary

In view of the phenominal growth in population and industries on Long Island the problem of the replenishment of ground-water is becoming increasingly important. The demands for utilization of water for domestic, industrial, cooling and air conditioning and agricultural purposes are increasing at a rapid rate so that conservation and strict control of the underground water resources of Long Island are a necessity, in order to be assured of an adequate supply for the future.

Current efforts to conserve ground water supplies on Long Island include recharge basins, storm water diffusion wells, diffusion wells for cooling and air conditioning waters, industrial waste treatment and water reuse and enlightened governmental agency study and control.

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Sir William Paterson is Dead

Sir William Paterson known to many in this country as the founder and long-time head of the Paterson Engineering Co., Ltd. of England died on August 9th, after a brief illness. For more than 50 years he was the active head of his successful and internationally known company until his retirement in January 1955. He was 82 years old.

Mr. Paterson was born in Roslin, Scotland, in 1874. He obtained his Technical education at Heriot Watt College in Edinburgh. He early recognized the importance of water quality and its treatment, and in 1902 established his own company for the development of water purification. Many new principles in water treatment were introduced by him, and to his credit are 70 British patents, some of which he dedicated to the Crown.

In 1944 William Paterson was accorded the honor of Knighthood, becoming "Sir William" in recognition of his contributions to the public interest and in water supply developments. Then followed the bestowal of Honorary Membership in the Institution of Water Engineers, the Royal Society of Health, and was made Honorary Fellow of his alma mater, Heriot Watt College. He was a member of the Institution of Mechanical Engineering and a "Life Member" of the American Water Works Assn.

In January, 1955 Sir William retired from the chairmanship of his company after having been in control for 53 years. However, some years before retirement he had rewarded his key employees with a participating interest in the company, and the following is what these employees had to say of their late chairman.

"During the whole of his life he was a man of great foresight and imagination with a directness of purpose and an integrity of thought, a generosity of disposition and a thoughtfulness for others which not only controlled all his actions, but also served as a pattern and stimulus to those who had the privilege of being in contact with him."

This is the William Paterson that we believed him to be from a rewarding association on the ocassions of his several visits to this country. Few in the water supply industry have been knighted—Sir William richly deserved such recognition.

"Ted" Moses Still in There Pitching

(A Correction)

In our August issue we published an article on "Early Pennsylvania Water Supplies" by Howard E. Moses, Director of the Division of Sanitary Engineering, Pa. State Dept. of Health.

In the by-line Mr. Moses was shown to be Director Emeritus and Consulting Chief Engineer, Bureau of Sanitary Engineering, Penna. State Dept. of Health. This was correct at the time the paper was prepared. However, since that time there has been a re-organization of the State Health Dept. and although Mr. Moses can still be titled Director Emeritus of the Bureau of Engineering, he is full time director of the Division of Sanitary Engineering and the title with his article should have been changed accordingly.

Industrial Waste Ordinances—Part II

A summary of Cincinnati's experiences in applying its ordinance.

by **DEAN M. TAYLOR**

Mr. Taylor is Senior Sanitary Engineer, Engineering Division, Department of Public Works, Cincinnati, Ohio. In this article, he reviews the steps and methods by which Cincinnati applied the precepts and principles which he set forth in Part I of this article.

CINCINNATI'S Industrial Waste Ordinance provides for collection of surcharges on industrial wastes as well as control of their discharge to public sewers[1]. All phases of the program are carried on by the Sewage Disposal Section, which also administers the collection of service charges, based on volumes of sewage.

The Sewage Disposal Section of the City of Cincinnati, Ohio, acted immediately, after passage of the Industrial Waste Ordinance, to carry out its directives. The primary objective was collection of the surcharge on industrial wastes which was levied to pay for those costs of treatment, imposed by industrial wastes, over and above "normal" sewage.

Preliminary Steps

The City of Cincinnati was fortunate in being able to apply its industrial waste ordinance before the sewage treatment plants were placed in operation. The Little Miami Sewage Works was placed in operation late in 1953 but more of the heavy industrial waste load will be discharged to the Mill Creek Sewage Works which will probably go into operation late in 1958. This period of grace has allowed a gradual tightening of application of the Rules and Regulations. The surcharges were applied as quickly as rates could be established. These surcharge rates for individual companies are subject to periodic review.

The Cincinnati Sewage Disposal Section employed all of the preliminary techniques mentioned in Part I. The Directory of Manufacturers for the Cincinnati Metropolitan Area, prepared by the Industrial Department of the Cincinnati Chamber of Commerce was reviewed for types of industries and specific companies. The system of classification used in the directory is the Standard Industrial Classification for Manufacturing Industries, compiled by and for the use of all federal agencies. The classified section of the telephone directory was also helpful in obtaining names and addresses of companies and products made or sold.

A general preliminary questionnaire was prepared and sent out to approximately 1900 companies. Some of the questions are shown in Illustration No. 1. About 1300 replies were received immediately and an additional 460 after 3 reminder letters, for a 97 per cent response. Of the replies received, 902 indicated no further action was necessary and were placed in a closed file. Then a more complete questionnaire was prepared, including such questions as shown in Illustration No. 2. It was explained that all laboratory analyses should be made according to the latest edition of "Standard Methods"[2].

After 6 reminder letters, 879 replied, but only 193 gave complete waste analyses. Review of the 879 questionnaires showed that 272 companies were subject to the service surcharge. The remainder were placed in the open file for further study. Subsequent investigation has placed some of them on the surcharge list. Preliminary field surveys were made at all the major companies and certain others to substantiate submitted information and fill out unanswered portions of questionnaire. These personal contacts were helpful in explaining certain features of the Industrial Waste Ordinance and answering questions.

When companies failed to submit waste analyses, the City used average national figures, based on published reports, and average values from similar industries. In addition, City Forces checked company wastes as quickly as possible to substantiate or correct the applied values.

This gaging and sampling program has been a continuing one. Industry as a whole has been cooperative because it has been familiar with the program. It had actually requested the City to build sewage treatment facilities capable of treating admissible industrial wastes in excess of "normal" sewage and had agreed to pay the additional costs for such enlarged treatment plant facilities.

Ed. Note: In Part I of this article, which appeared in the August issue of Water & Sewage Works, Mr. Taylor set forth general principles, responsibilities and methods of applying industrial waste ordinances. In an earlier article (Wat. & Sew. Wks., April 1956) Mr. Taylor discussed the policy, legal, financing, engineering, and technical requirements, in establishing, ordinances for the control of industrial wastes discharged into municipal sewers.

Surcharges

The service charges (for volumes) are based on the water consumption records of the water departments (26 political subdivisions have agreements with the City of Cincinnati to participate in the Metropolitan Sewage Disposal Program) and are placed on water bills. Meters are required for private wells and outside sources.

Present rates start at 8.0c per 100 cu ft for the first 500,000 cu ft monthly consumption and are graduated down for increased volumes. Sewage surcharges on industrial wastes are based on concentrations of suspended solids and BOD over and above "normal" sewage (300 ppm suspended solids and 240 ppm BOD) and the same volumes used as for service charges. The concentrations of waste constituents are weighted average values based on field surveys for representative time periods.

The surcharges are calculated by means of a formula but can be translated to $0.0129 per pound of BOD and $0.0105 per pound of suspended solids above "normal" sewage. These charges are also placed on the water bills. Payments on the bills are not accepted unless for the total. If bills are not payed, the City has the right to shut off the water or close the sewer connection until payments are made. Unpaid bills are certified to the County Auditor and placed upon the tax duplicate.

To maintain equity in the industrial

waste program, the City levies both service chrages and surcharges on effluents discharged to waters of the state when they exceed certain stream pollution standards. This action destroys incentive for circumventing proper discharge to public sewers and prevents local stream pollution.

The field survey program has been applied to check submitted data, and secure data on companies not submitting information. Over a year of continuous work was required to cover most of the effected companies. The program will be continued to keep the surcharge equitable and to maintain control of wastes discharged to the system. Out of about 250 companies paying the surcharge, 36 pay approximately 85 per cent of the total. More and more effort is being directed toward correct surcharge data for these 36 companies, particularly those whose wastes vary considerably. It was originally estimated that the annual surcharge revenue should be $500,000 to pay for the cost of treating industrial wastes stronger than "normal" sewage. In 1955 the actual receipts were $510,000. Surcharges for some companies increased, while others decreased. Provision has been made for review and possible change of rates at least every five years.

Prohibited Wastes

The City has taken most of the initiative and responsibility for controlling wastes prohibited from sewers. These prohibitions are clearly spelled out in the Rules and Regulations of the Industrial Waste Ordinance. Since the sewage treatment plants were not completed, initial action was to protect the collection system, and safety and health of personnel. When the Little Miami Sewage Works was placed in operation late in 1953, Sewage Disposal personnel immediately took steps to protect plant facilities and operations.

At present, effort is being made to control wastes properly which will affect Mill Creek Sewage Works which is scheduled to go into operation late in 1958. Those industries, which have assigned qualified people to industrial waste programs, have made much progress in controlling wastes prohibited from sewers. On the other hand, the City has had to assume practically all the responsibility for controlling prohibited wastes from small companies and those larger ones which have failed to carry out effective waste control programs. Accordingly, this action has raised operational costs of the Industrial Wastes Unit of the Cincinnati Sewage Disposal Section. It is anticipated that such costs can be reduced in time.

ILLUSTRATION NO. 1

Typical Questions of Preliminary Questionnaire

1. Name of company.
2. Address
3. Type of business (products manufactured or processed)
4. Periods of operation: Hr per week .., Days per year...
5. Number employees: Max ..; Min ..; Avg ...
6. Sources of water supply. Volumes ...
7. Types wastes discharged to sewers.

Efforts to control discharge of industrial wastes to public sewers have been fruitful. Discharge of prohibited wastes to sewers has been detected by both regular field surveys and special investigations. Strategic manholes along interceptors have been marked for inspection so that certain areas and industries can be pin-pointed when illegal discharge to sewers is suspected.

Whenever there is evidence of violation, the matter is taken up directly with the responsible people of the companies and the pertinent information sent to management in the form of letters. All wastes which damage or clog sewers are reported to the Highway Maintenance Division which immediately makes inspections and estimates of costs for repair and replacement. Such action has made industry aware of its responsibilities and all bills have been paid without court action.

To date, more than $135,000 have been collected for acid corrosion to sewers. Many companies have automatically recording pH meters and controllers to keep their wastes within the required limits of 5.5 and 9.5. When such materials as hydro-blast solids from a foundry, fly ash, boiler ash, sizing from paper processing, grease, and oils have interfered with sewage treatment, they have been traced back to the source and eliminated.

Cooperation with other city departments has been helpful in controlling industrial waste discharge to public sewers. The Rules and Regulations require submission of plans and specifications for pretreatment facilities to the City Manager and approval of same before installation. The Building Division of the Public Safety Department requires permits for plumbing changes and the Sewer Section of the Engineering Division of the Department of Public Works requires permits for new sewer connections. Neither of these agencies will issue permits without letters of approval from the Sewage Disposal Section. In this way industrial waste disposal information is made available for all enforcing agencies.

Industrial Waste Surveys

The mechanics of making industrial waste surveys have been difficult, particularly in old plants of considerable size. No company had a proper gaging and sampling station before application of the ordinance. Some plants had blind sewer connections requiring improvisations. The Rules and Regulations give the City Manager the power to demand installation of proper gaging and sampling facilities, but City forces have applied this power only in difficult situations.

Much improvement has been accomplished since passage of the ordinance. One company spent a half a million dollars to bring plant sewers together so that they would discharge through sampling stations to public sewers. Companies installing waste treatment facilities, remodeling their plants, or building new plants, are putting in proper gaging and sampling facilities at the same time. Another requirement serves as an incentive for consolidation of sewer systems. All costs for gaging and sampling more than two stations must be borne by the owner of the property.

During the first two years of mak-

ILLUSTRATION NO. 2

Typical Questions of Industrial Wastes Questionnaire

1. Person or persons, and title, to whom communications should be sent.
2. Methods of waste discharge (continuous, slugs, regulated).
3. Raw materials used.
4. Products manufactured or processed.
5. Are any wastes discharged to creek or open run?
6. Can waste lines be gaged and sampled?
7. Schematic flow sheet of waste lines.
8. Sampling, gaging, and laboratory analyses of wastes: sample identification (refer to waste flow sketch); volumes; suspended solids; B.O.D.; pH; ether soluble matter; other significant analyses.
9. Samples: Composites ..; grabs ...
10. Methods of sampling.

ing field surveys, the companies were given several weeks advance notice that City forces were coming in to obtain waste data. At present, the policy is that field crews will go into plants with only one or two days advance notice.

Field engineers examine sewer maps and all sewer outlets with plant personnel before setting up gaging and sampling stations. If the company has no flow measuring device, the setup crew must install one. Sharp-crested wires are used for the most part because they are the simplest and cheapest to install for temporary conditions. Circular weirs or orifices have been very useful in sewers, particularly when access is through manholes[3]. They are accurate as V-notch weirs, have much greater range of measurement (act as weirs for low flows and orifices for high flows), have little difficulty with clogging, and are relatively simple to install. Metal plates with different sized openings and prefabricated stilling wells can be quickly fastened to bulkheads. More and more companies are installing permanent gaging devices because they are interested in checking their own waste volumes. Flumes have proven to be the most satisfactory devices because of their non-clogging characteristics. Automatic recorders are also paying for themselves.

Sampling has presented numerous problems. Composite samples are always taken to determine representative characteristics of company wastes. Grab samples are taken for spot checks, particularly for such a characteristic as pH. Composites are taken for 24-hour periods, usually at 15 minute intervals. Duration of sampling is for one week of operation, which may be 5, 6, or 7 days.

Manual sampling has been used because automatic samplers have not been available for changing conditions of operation, particularly in sewers. Effort is being made to develop automatic samplers which can be moved repeatedly from station to station and will take representative samples under variable conditions. Such samplers would be much cheaper than manual sampling and would eliminate many labor problems (shelter for all weather conditions, sleeping on the job, not reporting for work, overtime, etc.). One supervisor per 8-hr shift could easily handle several stations.

Samples are composited in insulated, glazed, stoneware containers (8 gal). Individual portions are taken in wide mouth glass jars and added to the composites in increments proportional to flow. Charts show exact volumes to take, with no increments less than 40 ml. Various sized graduated cylinders are used to measure volumes (both Pyrex and polyethylene). When flows are low for extended time periods, it is necessary to take two composites; one for low flows and one for high flows, so that volumes of composites do not become excessive. These composites can be combined later on.

Most samples are preserved by storage at low temperatures. Ice is utilized in warm weather. At least two separate one-gallon portions are taken in glass jugs for each composite to the laboratory. Due precautions are taken to maintain representation whenever making sample transfers. The industrial waste laboratory of the Sewage Disposal Section adheres strictly to all requirements of "Standard Methods" for analyses used in determining sewer surcharges. When examining certain wastes (containing such materials as organic solvents and certain metals) it has been necessary to supplement "Standard Methods" with procedures substantiated by research. Feasibility of instrumentation has been demonstrated. Both a recording polarograph and a recording spectrophotometer are being used. The latter instrument operates in the ultra-violet, visible, and near infrared spectral regions and has a flame attachment. It can quickly scan many samples or examine others in minute detail, and leaves a permanent record. Useful data are stored in a punch card file.

Certain laboratory techniques have improved results. Use of magnetic stirrers has greatly increased both the accuracy and precision of sampling from containers. Aliquots are withdrawn with the mixers in action. Laboratory mixers or blendors are useful in preparing samples for analysis. Care must be taken, however, not to reduce solid particle size to the point that erroneous results are obtained for such analyses as suspended matter and dissolved matter. Naturally, they cannot be used for such a determination as settleable matter. Fine-tipped pipettes are not used for sampling wastes when suspended solids are affected. Tips are cut back and transfer pipettes recalibrated if accuracy is unduly reduced.

Explosive Gas Testing

The Sewage Disposal Section is responsible for policing the main intercepting sewers in Cincinnati.

Following reports of explosions in the main interceptor of the industrial Mill Creek Valley, an explosive gas testing program, was inaugurated. A delivery truck with a 9½ ft body was converted into a mobile field laboratory and equipped with various pieces of equipment, including a combustible gas indicator and 2-way radio. Gas samples can be taken in brass cylinders or concentrated in organic solvents (CCl_4 has been used) by use of gas bubbling cylinders connected to an electric vacuum pump.

A chemist was employed to operate the mobile laboratory in the field on a 40-hr a week basis. Within three months the source of a large amount of extraction solvent was located in a suburb of Cincinnati. Positive identification of the organic compound was made with a spectrophotometer (operating in the near infra-red range) in the industrial waste laboratory. The specific company's material was used as a standard. On the basis of this evidence, the company involved removed all volatiles from the sewers and disposed of them otherwise.

No explosive gas readings have been obtained from the Mill Creek Interceptor since that time. Elimination of this one major explosion hazard more than justified the original cost of the mobile laboratory and the DK spectrophotometer.

At present, the explosive gas testing program is being supplemented with a continuing monitoring program. Cloth bags containing activated carbon are hung above flowing sewage in key manholes along interceptors for a week or less. The carbon is then extracted with carbon tetrachloride and the extract examined in the DK spectrophotometer. Several contributors of relatively large amounts of fuel oils have been detected.

The mobile laboratory also assists in the field survey program for other industrial wastes. Certain waste discharges to public sewers and streams are examined in the field and samples delivered to the laboratory when necessary.

Application of Surcharge

Analytical data are turned over to engineers who calculate the surcharges of all companies subject to same. Concentrations of waste constituents from all sources are averaged according to flows obtained during field surveys to produce single values for each constituent from each company. The data are then fitted into the surcharge formula and a single cost value or factor per 100 cu. ft. of wastes determined. This cost factor is applied to the same volumes used in determining service charges

(water consumption less official exemptions) to determine the surcharge.

Average data from field surveys used in computing surcharges are sent to the respective companies in letters. If company representatives wish to examine the data in more detail, they can go directly to the Sewage Disposal Section and discuss data directly with engineers responsible for same. All gaging, sampling, analytical, and computational methods can be explained and demonstrated if necessary. This procedure provides direct answers to questions and avoids unnecessary delays and controversies.

In the event a company does not agree with the surcharge data obtained by the City, it can institute a program of re-sampling and gaging with subsequent laboratory determinations. It must submit a request for same by letter and bind itself to bear one half of the expenses by the City. Also, the person responsible for the company's data must observe and reach agreement with procedures used by the City. This procedure has been used several times during the period of application of the surcharge. All cases were settled to the satisfaction of interested parties.

If the findings, order, or decision of the City Manager made in pursuance of the provisions of the Industrial Waste Ordinance, or of the Rules and Regulations are not acceptable to any industry, such industry has the right to appeal as follows: Two reputable and competent engineers shall be chosen, one by the industry and the other by the City, neither of whom shall be a regular employee of either principal. Such persons shall act as referees.

As soon as such referees are chosen, the City Manager shall file with them a certified copy of the complaint and the decision of the City Manager, and it shall be the duty of such referees to investigate the complaint and to agree either to affirm or reject the findings of the City Manager and file a report with the City Council within a reasonable time, setting down their decision. If the referees so chosen are unable to agree, they shall choose a third engineer of like standing, and the decision, or recommendation of the majority shall be reported to the City Council. The decision or ruling of City Council shall be final and shall be reported to the industry and to the City Manager. Only one controversy has been brought to arbitration in this manner and this case is pending.

References

(1) Taylor, D. M. "Requirements for Establishing Industrial Waste Ordinances", *Wat. & Sew. Wks*, 103: 175 (1956)

(2) Standard Methods for the Examination of Water, Sewage and Industrial Wastes, 10th Ed. (APHA, AWWA, FSIWA)

(3) Dodge, E. R., "Flow of Water Through Circular End-Cap Orifices and Weirs, M. S. Thesis, Univ. of Wisconsin (1935)

B-12 Vitamin Production from Activiated Sludge Under Way at Milwaukee Sewage Plant

The dried activated sludge at the Milwaukee Sewage Treatment Plant, marketed as fertilizer under the name "Milorganite", is now yielding as a second valuable by-product the growth promoting vitamin B-12.

Prior to shipment of the "Milorganite" to fertilizer dealers it is put through an extraction process at the Milwaukee plant. Refining of the crude B-12 concentrate is performed by Armour Laboratories of Kankakee, Ill., a division of Armour & Co., meat packers and producers of biochemicals. The extraction plant, within the Milwaukee Sewage Plant, was installed by the Verne E. Alden Process Co., a subsidiary of the Verne E. Alden Co. of Chicago. The latter company is responsible for the development of the process for B-12 recovery from sewage sludge.

For the present the B-12 produced is being used to fortify poultry and animal feeds for its growth production value. It is anticipated that ultimately a highly refined B-12 product will be produced from the sludge extract for human uses also. This would be history making indeed —a by-product from sewage for human consumption. For the present only 10 tons of "Milorganite" per day are being extracted. The wet "Milorganite" filter cake is re-dried and sold without depreciation of its fertilizer values. Eventually the entire 72,000 ton annual output of "Milorganite is expected to be processed.

The Alden Process Co. will own and operate the vitamin extraction and concentration plant. The Milwaukee Sewage Commission will supply the raw materials and collect a royalty of 35% of the gross revenues (before taxes) from Armour's B-12 sales. Really sounds exciting—profits from sewage by-products, fertilizer plus vitamins. What next?

Richard Ford on Loan as Director of W.&S. Utilities Division in Dept. of Commerce

Richard V. Ford, of Haddonfield, N. J., Vice President and Export

Manager of the Ford Meter Box Co. has been appointed Director of the Water and Sewerage Industry and Utilities Division of the Business and Defense Services Administration, U. S. Department of Commerce. In the accompanying photograph Mr. Ford is being sworn in by BDSA Administrator Charles F. Honeywell.

Mr. Ford, on loan to BDSA from the government, will serve for some six months during which he will receive training that will qualify him as a reservist for any future emergency.

Mr. Ford is a 1922 graduate of Purdue University, where he received a B. S. degree in Chemical Engineering. In World War I he was an officer of Field Artillery. He served with the Navy in World War II and presently holds the rank of Commander, USNR.

After graduating from Purdue, Mr. Ford entered the employ of the Worthington Corp. of Harrison, N. J., as a cadet engineer. In 1928 he joined the Ford Meter Box Co. which was established by his father, Edwin H. Ford, in 1897. Mr. Ford is associated with his three brothers, Holton, Wilbur and John Ford, in the operation of the company.

Mr. Ford is Vice President Elect of the Water and Sewerage Works Manufacturers Ass'n., and is a long time member of the American Water Works Association.

He is married and has three daughters.

A Reminder to Plant Operators

Interested in a New Jersey Operator License

The New Jersey State Dept. of Health announces that Nov. 10, 1956 is the next filing date for Public Water Supply, Water Treatment Plant and/or Sewage Treatment Plant Operator licensing examinations. Further instructions and application forms may be obtained by writing the Department of Health, State House, Trenton 25, N. J.

28th Annual Conference

Penna. Sew. And Ind. Wastes Assn.*

IN ITS 30TH year, the Pennsylvania Sewage and Industrial Waste Assn. held its annual meeting. Once again the conference was held at Penn State University on August 29-31. It followed the annual meeting of the Penna. Water works Operators Assn.

Business

Total registration was 227 including 39 wives. For the latter there were lunches, bridge parties and a visit to an antique shop. In addition, entertainment for both men and women included attendance at a play ("The Desperate Hours") at the Standing Stone Playhouse—a "Barn" theatre about 17 miles from State College.

New Officers were elected as follows:

President: George A. Elias, Reg. Sanitary Engineer, Penna. State Health Dept., Philadelphia, Pa.

1st Vice Pres: B. S. Bush, Reg. San. Engr., State Health Dept., Wilkesbarre, Pa.

2nd Vice Pres: Harry W. McElhaney, Gen. Foreman, Production and Industrial Waste Disposal, Talon Co., Inc., Meadville, Pa.

Secretary-Treas: J. R. Harvey, Reg. San. Engr., State Health Dept., Meadville, Pa.

Editor: John Yencho, San. Engr., Kappe & Assoc., Greenburg, Pa.

Roy Weston, of Weston Eckenfelder & Assoc., continues as Director of the Federation.

At the banquet, T. R. Haseltine of J. N. Chester Engrs., was presented the *Bedell Award* of the Federation by Dave Lee, immediate Past President of the Federation. It was announced that Robt. Bolenius had been nominated for the Hatfield Award for this year. Also during the annual banquet, H. E. (Ted) Moses inducted five new members into the Sludge Shovelers Society. Of 57 members of this Society, 15 were in attendance at the meeting.

Ret. Pres.
L. L. Gwinn

President
Geo. A. Elias

1st Vice Pres.
B. S. Bush

Secy-Treas.
J. R. Harvey

Asst. Secy.
J. P. Durr

Fed. Director
R. A. Weston

Operators Round Table

On Wednesday afternoon a sewage works operators round table was held. Considerable enthusiasm was evidenced by the operators taking an active part. Robert M. Bolenius, Supt. Town of Abington, Pa., presided. DeWitt Kase, Exec. Mgr., Municipal Auth. of Sunbury, Pa. led off the session with comments about the quantity of gas produced from digestion. According to the amount of solids removed, for a city of 16,000 persons the gas quantity is lower than expected. There is reason to believe that sedimentation taking place in the sewers is sufficient to reduce by half, the quantity of raw sewage solids, that reach the plant. The settled sludge in the sewers is flushed out and because it has undergone partial decomposition, the usual amount of gas is not collected. It is going to be necessary to relay about 800 feet of sewer to overcome part of the difficulty.

At Sunbury water was found in several of the vertical shafts of the sewage pumps. Corrosion of one shaft resulted in failure. Steps were immediately taken to remove the moisture from the shafts of all of the other pumps.

Drying of Sludge

Mr. Bolenius read a paper prepared by Guy E. Croyle, Supt., Lewistown, Pa., on the drying of sludge on sand beds. The need for having free water in digested sludge in order to have it dry rapidly was mentioned but no mention was made about a method to determine the presence of free water. In the course of the discussion on sludge drying, it was stated from the audience that sludge would not dry if it had been digested for a long time. It is difficult to believe that such a statement could be true when so many have tried unsuccessfully to dry raw primary sludge. One operator commented on the impracticality of adding digested sludge to dried sludge added at a previous time, but there have been operators in various parts of the country that follow this procedure with success.

Operators believe that sand beds should be scarified and leveled prior to the addition of digested sludge. It was pointed out that high humidity in a covered drying bed hinders drying and that it is necessary to ventilate adequately these structures in order to get the most rapid drying. Apparently it takes more than the extremely high heat in a covered sludge bed to get the sludge dry.

* Reported by Prof. Don B. Bloodgood, Purdue Univ., and Editor of *Industrial Wastes.*

K. Allen Award
T. R. Haseltine

"Sludge Shoveler"
H. E. Moses

Digestion Tank Scum

Edwin W. Kuhn, Supt. Sew. Treat., Altoona, Pa., told about his experiences with a digestion tank floating cover that tilted. When the gas dome was removed a ten to twelve foot blanket of scum was found. Consideration was given to the breaking up of the scum by circulation of gas. This was not tried but compressed air was used successfully to break up the scum. Considerable concern was expressed by some individuals who thought that the mixing of air with gas in a digestion tank might produce an explosive mixture. Mr. Kuhn believes that much of the scum was made up of grease from a packing plant.

Grit in Digestion Tanks

K. H. Hendrickson, Supt. Sew. Treat., Beaver Falls, Pa. reported his sad experience with grit accumulations in six digestion tanks; as a result grit chambers were installed in 1955. A statement was made that few sewage plants in western Pennsylvania have grit chambers. T. R. Haseltine said that he believed that it might be more economical, in some situations, to clean digestion tanks than it would be to build grit chambers deep in the ground and operate them under adverse conditions.

Mr. Kase reported that he had experienced trouble with grit in his digestion tanks. The grit removal equipment does remove from one to twenty three cubic feet per day but some fine grit does get by the grit removal equipment and creates a serious problem in digestion tanks, a problem that appears to occur in many sewage treatment plants.

Mr. Bolenius said that it was necessary to remove grit from the digestion tanks at his plant in Abington, Pa. and that duplex plunger pumps will not remove it.

One operator commented on the difficulty that is experienced when grit gets into the packing of plunger pumps. It was claimed that in order to keep the grit out of the packing of any pump it was necessary to supply gland water at a higher pressure than is being exerted by the sludge pump. It was brought out, however, that there must be no cross-connection between the potable water system and the gland water supply. Most operators believe that it is advisable to have a trickle of fresh water running from the packing gland while a pump is in operation.

Oxidation Tests

Carmen F. Guarino of Philadelphia discussed the development of a test for measuring the character of activated sludge. A specific volume of activated sludge is taken and carbon dioxide free air diffused through it; the air is caught at the top of the sludge and passed through barium hydroxide solution to remove the carbon dioxide from it. The amount of barium carbonate produced is determined by tritrating with standard oxalic acid. Mr. Guarino showed curves of oxygen usage against time and stated that he could tell when the sludge was in the endogenous stage.

Air Force Problems

John E. Koruzo, Chief, San. Sect., Eng. Branch, Directorate of Const. Hdqt., U. S. Air Force, Washington, D. C., spoke on SEWAGE AND INDUSTRIAL WASTE DISCHARGES FROM U. S. AIR FORCE INSTALLATIONS.

Ch. Prog. Comm.
A. A. Estrada

Dir. Sh. School
C. B. Smith

Six inches is the minimum diameter of sewer that is used. Waste treatment plants for Air Force installations are designed on the basis of 100 gallons per capita per day. In December 1955, the Air Force was responsible for 28 billion gallons of sewage per day; 1.58 bgd was not being treated, 6.67 bgd were treated in municipal plants; 4.11 bgd were being given primary treatment, and 15.74 bgd were being given complete treatment.

Wastes from Air Force installations are made up of domestic and industrial discharges. Industrial wastes come from thoroughly washing aircraft each time they are overhauled. To wash a plane of the B-36 type requires 200 to 300 gallons of kerosene, 20 to 40 gallons of "gunk", (a detergent) and 8000 to 12,000 gallons of water. The wash water contains emulsified oils that have to be removed before the waste can be discharged. Flotation units have been employed and in 15 minutes of retention the oil can be reduced to 10 to 15 ppm. Recovery of kerosene has been attempted but no successful process has been developed. A plant for treatment of wastes from aircraft washing costs $102,000.

Oxidation Lagoons

Mr. Koruzo reported on the inspection trip that he has made to a number of the municipal oxidation lagoons. He said that some that he had inspected gave off odors that could be detected at a distance of one-fourth to one-half mile, while others had no odor at all. Some of the lagoons were operating without screens or equipment for grinding.

Preventive Maintenance

Harold A. Pfreimer, Chief, San. Lec., Maint. Div., Directorate of Facilities Support, Hdqt. U. S. A. F., Washington, D. C., pointed out the importance of preventive maintenance in keeping sewage treatment facilities

R. A. Bolenius

C. D. Kase

E. W. Kuhn

K. H. Hendrickson

Operators' Forum

operating with the minimum of expense. He says that the Air Force has a base zoned and that once every 90 days a "head to toe" inspection is given the treatment plant equipment. The sewage plant operators take care of the normal maintenance.

Other Technical Sessions

Edward H. Bryan, Plastics Technical Service, Dow Chem. Co., Midland, Mich., spoke on SOMETHING NEW IN TRICKLING FILTERS and gave a comparison of a Dowpac HCS prototype unit at two hydraulic rates, an original Dowpac unit, and a stone filter when treating phenol. Mr. Bryan's studies have been reported on before at the Purdue Ind. Waste Conf. and elsewhere and will not be reviewed here. This paper was discussed by Professor R. R. Kountz, of Penn. State, who has done extensive research with the plastic materials as filter media.

Paper Wastes

Dr. Harry Gehm, Tech. Director of the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries Inc.) presented a paper on MODIFICATIONS OF THE ACTIVATED SLUDGE PROCESS IN PULP AND PAPER MILL EFFLUENT TREATMENT. Dr. Gehm believes that paper mill effluents can best be treated by biological oxidation. The activated sludge method may in time provide the best available technique in areas where sufficient adaptable land is unavailable or climate is unsuitable for natural oxidation processes. Loadings as high as 120 lb per 1000 cu ft of aerator capacity have been used.

James E. Lebo, Res. Chem., West Virginia Pulp and Paper Company of Tyrone, Pa., presented a paper that described studies of the TRICKLING FILTERS IN TREATING PULP AND PAPER MILL WASTES. These studies were made on wastes from modified sulfate cooking with chemical recovery. He found that equally satisfactory B.O.D. reductions could be accomplished by trickling filters as by activated sludge, with an application rate of *27.7* mgad and a nutrient feed of 5 ppm of nitrogen. With two filters in series a B.O.D. removal of 45 per cent was obtained in the first filter and 21 per cent in the second filter.

The papers by Mr. Lebo and Dr. Gehm were discussed by Roy F. Weston, of Weston, Eckenfelder and Associates, and by F. B. Milligan, Pa. Dept. of Health, Harrisburg, Pa.

—— Programmers ——

H. B. Gerber J. E. Koruzo H. A. Pfreimer E. H. Bryan

Atomic Power Wastes

The production of atomic power has been attracting much attention. E. C. Tsivoglov, San. Engr., Wat. Poll. Cont. Sect., R. A. Taft, San. Eng. Center, USPHS, presented a paper on SOURCES AND CONTROL OF RADIOACTIVE WATER POLLUTANTS. He told about some of the problems that have been encountered in planning the Shippingport, Pa. Reactor. The pollution of waters with radioactive materials has to be measured in parts per billion rather than in parts per million. It has been found that waters in the western United States are considered to be dangerously polluted when they contain as little as one part per billion of radium. In planning to handle the wastes from the reactor the quantity, duration of discharge and the type of isotope have to be considered. It will not suffice to monitor the discharged waters because biological organisms may concentrate the very dilute radioactive substances that may be in the water.

J. R. LaPointe, Sr. Engr., Westinghouse Bettis plant, discussed RADIO-ACTIVE WASTE DISPOSAL AT THE SHIPPINGPORT NUCLEAR POWER PLANT. Mr. La Pointe said that the three ways to get rid of radioactive materials are: (1) natural decay, (2) concentration and storage, and (3) dilution. It is estimated that the average volume of liquid waste for the Shippingport Reactor will be 16,000 gallons per month. The solid wastes will amount to 36 cubic feet per month and the quantity of combustible will vary from 2000 to 4000 pounds per month. Items such as tools and metal turnings that have become radioactive will have to be placed in 30-gallon drums and sealed, placed in larger drums and then shielded by pouring concrete between the two drums and shipped to the coast for ocean burial.

Milk Wastes

H. G. Harding, Sen. Scientist, Nat. Dairy Res. Labs., Inc., gave a REVIEW OF MILK WASTE TREATMENT METHODS. He pointed out that there are some processing plants in Pennsylvania that have cut their losses so that the waste waters contain as little as one pound of B.O.D. for each 1000 pounds of milk received. He stated that any method of treatment that can be used for municipal wastes can be used to treat milk wastes.

—— Pulp and Paper Wastes ——

J. A. Lebo J. W. Hassler H. W. Gehm H. T. Reuning F. B. Milligan

E. C. Tsivoglou

A. P. Zechella

Radioactive Wastes

The disposal of sludge from milk waste treatment plants was discussed. The sludge from the milk waste treatment plant at Coldwater, Ohio is so well oxidized that it can be placed on drying beds without causing a nuisance.

Praise was given the spray irrigation method for milk waste disposal. The capital cost for an installation is about $5000 for 25,000 gallons per day of waste.

S. I. Zack, Cons. Engr., Gannett, Fleming, Corddry and Carpenter of Harrisburg, Pa., discussed the Harding paper and told about the satisfactory operation of the Belville, Pa., plant that is treating 412 pounds of B.O.D. in a plant designed for 325 pounds per day. The effluent discharged contains only 84 pounds of B.O.D. per day.

A formal discussion on milk wastes by C. L. Siebert, Jr., Pa. Dept. of Health, was read. Mr. Siebert recommends a small digestion tank, even though complete oxidation of the solids is planned. He mentioned the possibility of considerable pollution of streams when the washing of bulk storage tanks on farms becomes common practice. When cans are used to transport milk they are washed at the receiving station.

Vacuum Filtration

The paper, MODERN PROBLEMS OF VACUUM FILTRATION, by Gordon J. Wiest was read by John J. Fetch. In the discussion that followed Mr. George D. Simpson of Havens and Emerson, Cons. Engr., stated that he did not believe that ground garbage in sewage interfered with filtration of digested sludge.

Control Analysts Breakfast Session

Bruce Gerber, Leader

At the breakfast meeting staged by control analysts discussions centered around the subject "What has automation to offer the field of sewage and industrial waste treatment." Discussions began with those in attendance describing automatic devices they were using or with which they were familiar. Such devices included (1) Liquid Level Controllers, (2) Pump Controllers, (3) ph Controllers, (4) Oxidation—Reduction Potential Controls (5) Volumetric Controls for Programming Chemical Feeding Devices, (6) Pumping Station Alarm and Signal Systems, etc.

S. I. Zack

C. L. Siebert, Jr.

Milk Wastes

The question of whether sewage and industrial waste people were embracing automatic control devices to the same extent as their fellow engineers in the wet process industries was asked equipment people present. Their answer was an emphatic "NO."

Operators pointed out that the reason for this is the fact that automatic controls are fine where the variables which affect control systems are known; but, until basic research uncovers more of the variables which affect wastes process control systems, sewage works automation will be slow in materializing. Other reasons given for not making greater use of automatic devices in waste treatment plants was (1) their complexity, (2) the caliber of personnel normally associated with treatment plant operations, (3) maintenance difficulties, (4) cost of maintenance etc.

Town of 500 Looses Its "Private—Public" Water Supply

Missouri's public service commission has ruled that it would be all right for Mrs. Ruby Bonham to get out of the water business at Mokane, Mo., because technically she never operated a public utility anyway.

Mrs. Bonham's father back in 1919 laid a water supply line to his home. It ran through the town of Mokane (Pop. 500). Bit by bit others received permission to hook onto the line—some, too, without permission. In the latter category was found the town's high school.

Mrs. Bonham, finding that she had inherited a worrisome and losing business, decided to just shut off the water and quit. Some 43 "customers" filed a petition with the Public Service Commission. This was an eye opener to Mrs. B whose records showed only 39 legitimate users—4 having just hooked on to a handy free-water supply line.

The Commission took the stand that Dr. Williamson the installer of the water line "never solicited customers and never offered to serve water to the public generally." Therefore, the Commission had no jurisdiction and the next move is up to those interested in a public water supply for Mokane.

Tidy Sum Invested in Detroit's Sewers

During the past decade Detroit has put more than $51,000,000 into sewer construction. The following figures show the expenditures for sewers installed year by year (1946-1956) of which more than $11,000,000 was spent in the past year.

Fiscal Year	*Expenditures*
1946-47	$ 34,510
1947-48	3,080,646
1948-49	3,089,197
1949-50	7,809,197
1950-51	4,643,337
1951-52	5,138,680
1952-53	4,664,986
1953-54	5,890,295
1954-55	5,671,557
1955-56	11,053,558
Ten Year Total	$51,076,253

Harry Hendon & Associates

Successor to Long Established Birmingham Engineering Firm

The long established engineering firm, Polk, Powell and Hendon of Birmingham, Ala., will henceforth be known as Harry Hendon & Associates.

Mr. Hendon has purchased from H. A. Powell his interest in the old firm and the business will be conducted under the name and style of Harry Hendon & Associates.

Mr. Hendon's associates in the new firm are Lewis E. Hoffman and Afton B. Jowers, both having been senior members of the staff of Polk, Powell & Hendon Engineers for a number of years.

The address of the reorganized firm is the same as the old firm—Chamber of Commerce Building, Birmingham, Ala.

"Science is a first-rate bit of furniture for a man's 'upper chamber' provided he has common sense on the ground floor."—*Holmes*

REPORT FROM ABROAD

Synthetic Detergents in Sewage

A review of the findings of a committee of fifteen

by JOHN FINCH

Mr. Finch is Manager of the Sewage Disposal Department, Slough, England. In his reports from abroad he discusses topics and opinions of timely interest. He welcomes the opportunity of replying personally to readers desiring additional information regarding subjects covered in his series.

PERHAPS the best glossary of information on synthetic detergents has recently been issued by the Ministry of Housing & Local Government, through Her Majesty's Stationery Office in London. It was a coincidence that the Report was published on the very day that W. T. Lockett, Chief Chemist to the Middlesex County Main Drainage Department, presented his important paper "Synthetic Detergents in Relation to the Purification of Sewage: Experiments and Operating Experiences at the Mogden Works", to the Annual Conference of the Institute of Sewage Purification.

Majority Opinion

The Report states:—"The majority of us, (there were fifteen members of the committee) including the chairman, are sufficiently impressed by the evidence already available to feel that the possibility (we put it no higher) of a serious situation arising before research has shown a practical remedy, or even of the effects at present noted being found more serious than they are now rated, cannot in prudence be ignored.

"This majority opinion is that in either such eventuality the exercise of control over the composition of household synthetic detergents would be necessary in the public interest—and might conceivably be needed at fairly short notice. Statutory powers for a control of this kind are not at present available.

"This majority of us therefore recommends that the Government should consider very carefully whether to seek these powers now, for holding in readiness as a safeguard for the public, or to defer obtaining them until a clear need for their exercise has arisen".

Minority Opinion

A report made by the minority of four members considers that "it would be both unrealistic and undesirable to assume on present information that any real risk of a serious situation arising in the future, involving a need for control, exists at all".

It may be recalled by readers that the committee on Synthetic Detergents was set up by the Minister of Housing & Local Government in 1953 to examine and report on the effects of the increasing use of synthetic detergents and to make any recommendations that seemed desirable with particular reference to the public health services.

The Minister of Housing & Local Government, Mr. Duncan Sandys, Sir Winston Churchill's son-in-law, is studying the committee's findings and recommendations, on which a number of interests and bodies will have to be consulted.

The committee in their investigations decided not to take evidence formally and in public, but took full advantage of the fact that individual members of the Committee and the organizations with which they were associated, had between them various means of access to all the chief sources of authoritative information on the subjects coming within the purview, as well as to the considerable amount of literature that some of these subjects had given rise to. The information gained in this way was supplemented by replies to inquiries addressed on the behalf of the committee to a wide range of public and other bodies; by the results of investigations and experiments carried out at their request; and by the tour of investigation in the United States.

The Committee says that of the mass of evidence that has been collected, there is not much that is by itself final and conclusive. Some of the evidence obtained may have only a local value, and the interpretation of the necessarily limited amount of experimental work it has been possible to get done specially for the purpose of the Committee, has proved extremely difficult. It has therefore not been feasible to present a report consisting primarily of a comprehensive body of established facts that speak for themselves. Rather, the Committee has found it necessary to note the existence and assess the strength as best they could of a large number of indications, and relate these to known facts and needs as seen by the Committee.

Aspects of Problem Covered by Report

The Report covers all aspects of the detergent problem including the nature and development of syndets; the effects of syndets at the place of use; syndets at sewage treatment plants; effects of the use of syndets on Rivers and Streams to which sewage effluents are discharged; syndets and water supplies; implications of the persistence of ingredients of syndets in sewage treatment plants and in the waters to which sewage effluents are discharged; it concludes with a very important summary of conclusions and recommendations.

Observations on Foaming

It is of interest to note the observations made in the Report on foaming at sewage treatment plants.

A questionnaire was sent out to most of the large activated plants operating in Great Britain. Foam was reported at all but one of 38 treatment plants; it varied in intensity and was serious at 23 of them. Comments from operators ranged from "excessive foaming but no particular trouble" to "at times it builds up to a depth of over 10 feet".

A questionnaire sent out to biological filter plants indicated that of 44 treatment plants using filters, some foaming was reported from 33 of the plants, ranging from "slight foaming" to "foaming to a depth of 4 to 6 feet". Foaming was also reported where filter effluent was pumped back to the filter inlet, as at some modern plants.

Attempts at controlling foaming at the sewage treatment plant have been varied including spraying with effluent, adjustment of the operation of activated sludge plants to increase the concentration of suspended solids in the aeration tank, and the use of defoamers.

Spraying has been reasonably successful at some plants, and the Committee states that it could be a useful method at some plants in the absence of a better solution of the difficulty.

The increase of the suspended solids concentration in the mixed liquor in the aeration tank at activated sludge plants, has not been exploited as much as would have been liked, because of the limitations which relate to the primary need to insure that at all times the oxygen demand of the mixed liquor is satisfied. This oxygen demand increases with an increase in the concentration of suspended solids, but the supply of oxygen is limited by the capacity and design of the available plant.

Another limitation to this method of operation is the lack of capacity in pumping equipment and pipelines to deal with the greater quantities of solids which would be handled.

However, trials were carried out very thoroughly and results supplied in great detail at four treatment plants where the necessary adjustment proved possible. At two of the four works, there was no difference in the amount of foam. At the other two, a slight reduction of foaming was noticed, but the foam was still a nuisance. In these experiments the concentration of suspended solids in the mixed liquor was taken to double the normal value, and indeed, to a point where the quality of the effluent suffered.

FOAM on river below sewage works

The use of chemical defoamers has attracted some attention and one of these based on petroleum oils has been put to use in one of the largest plants in this country. Experience seems to indicate that a concentration of 2-3 parts per million of the sewage flow may be efective, and at a cost which would not be prohibitive. However, I think it should be pointed out that the River Authorities are not entirely agreeable to the practice of using these oil-based defoamers as yet, and a lot of experimental work is being carried out in connection with such use.

The extension of the purification cycle in the activated sludge plant to the nitrification stage has been reported from at least two large authorities, to control the production of excessive foaming.

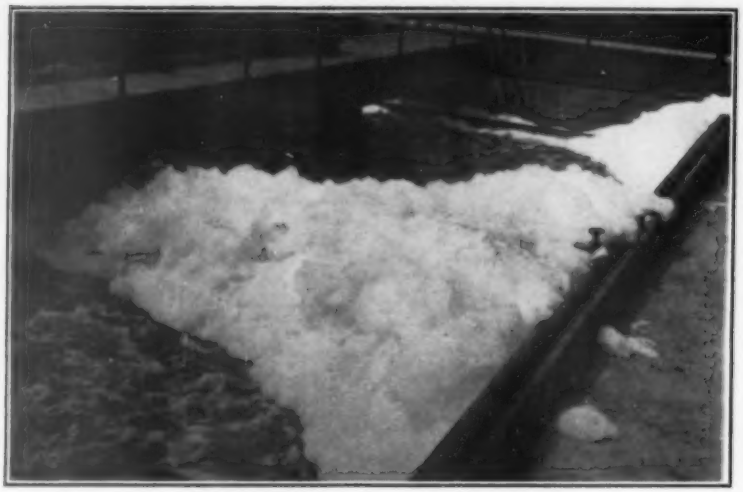
Mogden Experiences

One of the most important aspects of the synthetic detergent problem as affecting sewage treatment processes, is the retardation which occurs in the biological oxidation cycle. At the Mogden works of the Middlesex Main Drainage Department, it was found that if it was to produce as good an effluent with the synthetic detergent-containing sewage, as was produced in the pre-1950 days when syndets were not present, then the plant would deal with only four fifths of the load. The estimated capital cost of the extra plant which would be required to restore the standard of purification then given at Mogden would be of the order of £600,000! (More than $1,600,000).

Mr. Lockett in his paper delivered to the Institute of Sewage Purification Conference referred to foaming caused at the Mogden diffused air activated sludge plant, and stated that foam may be kept well under control by the treatment of the sewage to the point of advanced nitrification. He went on to say that much importance is attached to the syndets adsorption properties of sewage sludges, and he brings forward evidence to show, that, in relation to the activated sludge process, and in particular the diffused air system, this property coupled with such factors as the state of oxidation of the sludge in circulation has a substantial bearing on the effects of syndets on the process. Where the sludge is in a well oxidized state and consequently of high density, and present in reasonable amounts, the harmful effects of syndets resistant to oxidation is minimized, as a consequence of the greater adsorption of the syndets by the sludge and the lowered concentration of free detergent in solution in the mixed liquor.

Effect of Syndets in Water Supplies

Mr. Lockett also referred to the viewpoint held in South Africa on the problem of synthetic detergents and water supply. He said that one should not ignore the very important advantages to be obtained from biologically-oxidizable synthetic deter-



FOAM on surface of aeration tanks

gents in countries where water is a very scarce commodity.

It will be recalled that Dr. G. J. Stander, chairman of the South African Branch of the Institute of Sewage Purification, in his address at the opening of the first Conference of the Branch in 1954, stressed the need for conservation of water in South Africa, and intimated that the widespread household use of biologically unoxidizable synthetic detergents constituted a very serious threat to public health and water supply in that country.

The Committee on Synthetic Detergents states that there is a limit in practice to what can be done by way of purification, whether at sewage treatment plant or at the water works. No practicable means of sewage treatment can insure the discharge of effluent consisting of water entirely free from sewage derived contaminants, and no water works treatment on a practicable scale can insure that where such contaminants are present in the raw water, they can be entirely removed before putting the treated water into supply. The widspread use of synthetic detergents which now find their way into sewage has resulted in an altered situation insomuch as the sewage now contains complex compounds which are not completely destroyed during sewage and water treatment, which exercise adverse effects at the sewage treatment plant and at the water works, and which, in some instances gets back to the domestic consumer, in drinking water, as a new added ingredient of no apparent benefit and of unknown long-term effect!

Committee Recommendations

The Committee on Synthetic Detergents makes eight recommendations as follows:—

1. Further improvements should be sought in the methods available for determining small concentrations of surface active material in sewage, sewage effluents and water.

2. Regular determinations should be made of the concentrations of surface active materials and phosphates present in all sewage effluents discharged in sizeable quantities into rivers.

3. Water utilities drawing supplies from such rivers should make regular determinations of the concentrations of surface-active materials (and, where appropriate, phosphates) present both in the raw water at their intakes and in the treated water they supply for public consumption.

4. The possibility of long-term effects on health being caused by the drinking water containing such concentrations, or by the use of crockery, and so on, washed with synthetic detergents and not rinsed, should be kept under permanent review.

5. The information obtained about the concentrations of surface-active materials in public water supplies should be made available to the health departments.

6. Investigations should be further pursued at selected sewage works into the possibility, with existing or new methods of treatment of effecting more rapid and complete destruction or elimination of the main ingredients of the present common types of household synthetic detergents, and the suppression of any foam nuisance to which their presence during purification gives rise.

7. At the same time, manufacturers of household synthetic detergents should investigate the feasibility of producing efficient washing products based on materials which can be readily oxidized or eliminated, and which will not cause persistent foaming during sewage treatment by present available methods.

8. An advisory body, including representatives of the sewage authorities and manufacturers concerned, and of appropriate Government departments, should be set up to give advice and facilitate research on all these matters; to keep the progress of the research under review; and meanwhile to watch the position at sewage works, on rivers, and in the water works concerned, in relation to the continued use of the synthetic detergents of the present common type.

Milwaukee Faced With Need For Another 25% Water Rate Increase

Having just recently been granted a 25% increase in water rates by the Wisconsin Public Service Commission, it now appears that Milwaukee will soon be knocking on the Commission's door asking for an additional 25% rate increase.

Reason for the need for an additional 25% water rate boost is the proposed betterments to the Milwaukee system, including an additional filtration plant and pumping station, as recommended by Black & Veatch, Engineers of Kansas City, retained to develop a long term water supply plan and program for Milwaukee.

The recent 25% rate increase appears inadequate to provide a net income sufficient to cover interest and principal reduction on the proposed 50 million dollar revenue bond issue needed to finance water works construction costs over the next five to six years, as advocated by Milwaukee's consultants.

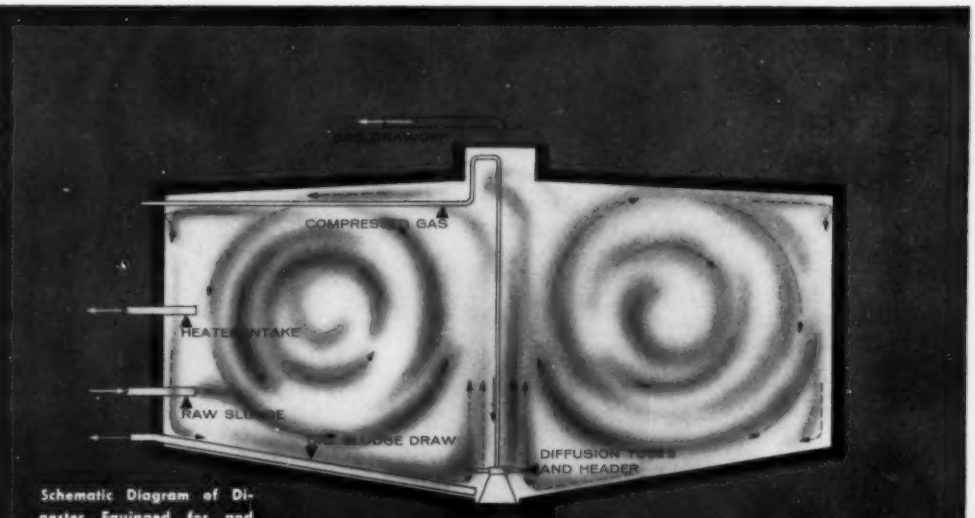
Ed. Note: We wonder if the second 25% rate increase superimposed on the first 25% increase would be necessary if the City Council of Milwaukee would return to the Water Department the many thousands of dollars transferred from water sales net income (surplus) to the General Fund over a period of years *Question*: which is most justified: Revenue bond financing and the 50% rate increase, or a smaller revenue bond issue in combination with G. O. bonds and a 25% rate increase.

"from Chicago"

LOWER COST DIGESTION

through exclusively highest solids loading with "CRP*"

*Catalytic Reduction Process



Schematic Diagram of Digester Equipped for and Operation Under CATALYTIC REDUCTION PROCESS.

RESULTS IN:

1. Smaller tanks.
2. 1/3 to 1/7 of former digester volume for biological requirements of sludge digestion† (Contrasted to actual requirements of former methods of digestion).
3. Non-formation of dense floating solids, termed "scum", eliminating former pro-ration of digester volumes for holding "scum".
4. Consistently highest degree of volatile solids reduction and gas production —through fundamental application of a simple gas diffusion mechanism— with lowest tank volume and simplified piping (as illustrated above), without increase in operation supervision requirements.

†*Exclusive of sludge storage volume that may be required by subsequent disposal methods.*

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fmc

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Subsidiary of Food Machinery and Chemical Corporation

SEWAGE EQUIPMENT DIVISION

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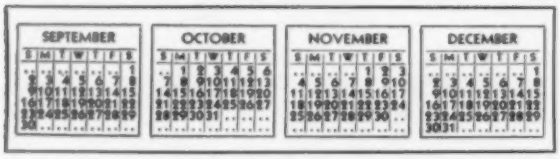
W & SW

Meetings Scheduled

1956



Oct. 8-11—Los Angeles, Calif. (*Hotel Statler*)
FEDERATION OF SEWAGE AND INDUSTRIAL WASTES ASSNS., Ralph E. Fuhrman, Exec. Secy., 4435 Wisconsin Ave., N.W., Washington 16, D. C.

Oct. 9-12—Atlantic City, N. J. (*Chalfonte Hotel*)
PENNSYLVANIA WATER WORKS ASSOCIATION, John H. Murdoch, Jr., Pres., American Water Works Service Co., 121 S. Broad St., Philadelphia 7, Pa.

Oct. 10—Caribou, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

Oct. 14-17—Little Rock, Arkansas (*Marion Hotel*)
SOUTHWEST SECTION, A.W.W.A., Secy., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 15-16—St. John, New Brunswick (*Admiral Beatty Hotel*)
MARITIME BRANCH, CANADIAN SECTION, A.W.W.A., J. D. Kline, Secy.-Treas., Public Service Comm., P.O. Box 608, Halifax, N. S.

Oct. 15-17—Philadelphia, Pa. (*Drake Hotel*)
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, NORTHEAST REGION, A. B. Campbell, Exec. Secy., 1061 M & M Bldg., Houston 2, Texas

Oct. 15-19—Pittsburgh, Pa. (*Wm. Penn Hotel*)
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

Oct. 18-20—Atlantic City, N. J. (*Hotel Madison*)
NEW JERSEY SECTION, A.W.W.A., Secy., C. B. Tygert, Box 178, Newark 1, N. J.

Oct. 21-24—Mobile, Alabama (*BattleHouse*)
ALABAMA-MISSISSIPPI SECTION, A.W.W.A., Secy., Irving E. Anderson, Dist. Engr., Surface Water Branch, USGS, Box 2052, Jackson, Miss.

Oct. 22-24—Pittsburgh, Pa. (*Hotel William Penn*)
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA (17th Annual Water Conference) W. M. Porter, Secy., Hotel William Penn, Pittsburgh 30, Pa.

Oct. 23-26—San Diego, Calif. (*U.S. Grant Hotel*)
CALIFORNIA SECTION, A.W.W.A., H. J. Ongerth, Secy.-Treas., 2151 Berkeley Way, Berkeley, Calif.

Oct. 23-26—San Antonio, Texas (*Gunter Hotel*)
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, SOUTH CENTRAL REGION, A. B. Campbell, Exec. Secy., 1061 M & M Bldg., Houston 2, Texas.

Oct. 24-26—Des Moines, Iowa (*Hotel Fort Des Moines*)
IOWA SECTION, A.W.W.A., Secy., J. J. Hail, Supt. of Water, City Hall, Dubuque, Iowa.

FORESIGHT and "FLEXIBLES" Pay Off in Dallas

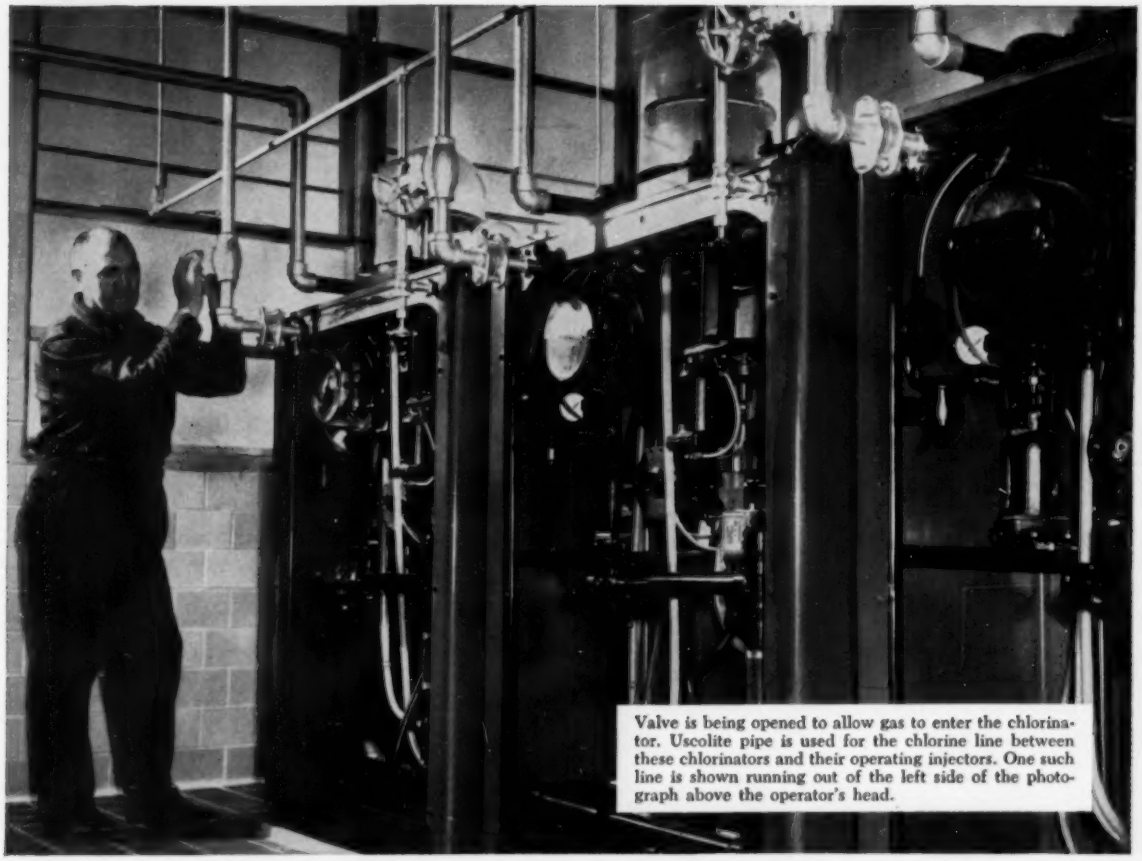
Today the Dallas Sewer Maintenance Department has approximately the same number of men as in 1951, yet the population has grown 23.8% and the sewer cleaning problems proportionately.

The greatly increased cleaning capacity per worker can be credited to the foresight of Superintendent Henry Graeser. In 1951 he started a modernization program. Today the sewer crew is equipped with this mechanized fleet of "Flexible" Bucket Machines and SeweRodeRs.

FLEXIBLE INC.
3786 Durango Ave., Los Angeles 34, Calif.
(Distributors in Principal Cities)

Let our nearest representative offer specific recommendations for modernizing your department.

USCOLITE PIPE



Valve is being opened to allow gas to enter the chlorinator. Uscolite pipe is used for the chlorine line between these chlorinators and their operating injectors. One such line is shown running out of the left side of the photograph above the operator's head.

For flexibility, corrosion-resistance and durability in handling chlorine

this sewage plant relies on chlorinators equipped with Uscolite Pipe

"That's because the highly corrosive chlorine does no damage to Uscolite", says an engineer with Wallace & Tiernan Inc., makers of the chlorinators used in the Westchester County Sewage Disposal Plant, New Rochelle, N. Y. Wallace & Tiernan say they find Uscolite Pipe excellent as a carrier of moist chlorine gas and chlorine solutions. They are constantly extending its use for chlorine solution lines at their installations.

Uscolite® plastic pipe is extremely light in weight, yet has very high impact strength. It will resist acids, salts, alkalies and gases, inside and out. Uscolite has the seal of approval of the National Sanitation Foundation. Completely new or replacement piping—plus a wide variety of pipe fittings, valves and sheet, slab and rod stock—all are obtainable at any of the 28 "U.S." District Sales Offices, at selected distributors or by writing us at Rockefeller Center, New York 20, N. Y. In Canada, contact Dominion Rubber Co., Ltd.

(At right) Reading dial on an operating injector. Pipe leading to left and up is Uscolite.

Mechanical Goods Division

Watch NCAA football, Saturday afternoon, NBC-TV

United States Rubber

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HEAVY DUTY and LIGHT DUTY

ALSO NON-CLOG SIZES UP TO 8"

AURORA Always PUMPS
For all sump drainage; liquids handling in industry; transfer of chemical and hot liquids; handling viscous or high temperature liquids; boiler blow-off; heating returns etc.; also for handling screened and unscreened sewage and industrial waste.
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HANDLES MOST CORROSIVES

...at lower cost

ACE-ITE

is a moderately priced, general-purpose, rigid plastic pipe with exceptional impact strength. For handling most inorganic acids, salts, alkalis and many organic chemicals, it's the equal of plastics that cost far more. Light weight, odorless, tasteless. Temperatures minus 40 to 170°F. Sizes ½ to 6", with fittings. Ace-Ite is only one of *eight* types of rubber and plastic pipe now made by ACE. Write today for free technical Bulletin 80.

ACE rubber and plastic processing equipment • SINCE 1852

AMERICAN HARD RUBBER COMPANY, 93 Worth St., New York 13, N. Y.

Oct. 24-26—Baltimore, Maryland (*Sheraton Belvedere*)
CHESAPEAKE SECTION, A.W.W.A., Secy., Carl J. Lauter, 6955 33rd Street, Washington 15, D. C.

Oct. 29-31—Windsor, Ontario (*Prince Edward Hotel*)
THE CANADIAN INSTITUTE ON SEWAGE & SANITATION, A. E. Berry, Secy.-Treas., Ontario Dept. of Health, Parliament Bldg., Toronto, Canada.

Oct. 31-Nov. 1-2—Bluefield, W. V. (*West Virginia Hotel*)
WEST VIRGINIA SECTION, A.W.W.A., Secy., Hugh W. Hetzer, Engr., W. Va., Water Service Co., Charleston, W. Va.

(*Jointly With*)

WEST VA. SEWAGE & IND. WASTES ASSN., G. O. Fortney, Secy.-Treas., State Health Dept., Charleston 5, W. Va.

Nov. 1-2—Omaha, Nebraska (*Castle Hotel*)
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN., V. J. Lechtenberg, Secy.-Treas., 614 Standard Oil Bldg., Omaha, Neb.

Nov. 7-9—Old Point Comfort, Virginia (*Chamberlin Hotel*)
VIRGINIA SECTION, A.W.W.A., Secy., J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 8—Greenfield, Mass. (*Hotel Weldon*)
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSN., Henry F. Munroe, Secy.-Treas., 75 Paine Ave., Cranston 10, R. I.

Nov. 11-14—Daytona Beach, Fla. (*Daytona Plaza Hotel*)
FLORIDA SECTION, A.W.W.A., Secy. Jay D. Roth, City Hall, Miami Beach 39, Fla.

(*Jointly With*)

FLORIDA SEWAGE & INDUSTRIAL WASTES ASSN., M. E. Dawkins, Secy.-Treas., % Reynolds, Smith & Hills, P.O. Box 4817, Jacksonville 1, Fla.

Nov. 12-14—Charlotte, N. C. (*Hotel Charlotte*)
NORTH CAROLINA SECTION, A.W.W.A.,

(*Jointly With*)

NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSN., W. E. Long, Jr., Secy.-Treas., Box 2091, Raleigh, N. C.

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A few steps from the Conservatory and Zoo
. . . just a few minutes to the Chicago Loop.
See Chicago from our roof . . .
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Equipment — Products
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MUELLER®

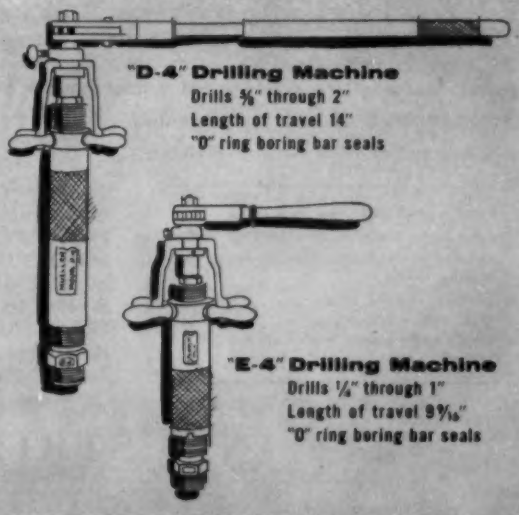
Connect services to any main!

Service Clamp
Tapping size ½" through 2"
Iron pipe or Mueller thread
Neoprene or lead ring gasket
Single or double strap
Pipe sizes 1" through 12"

Make service connections quickly and easily to steel, cast iron and all classes of asbestos cement mains. Depending upon the size required, the Mueller "E-4" or "D-4" drilling machine may be used to activate the service, under pressure, without loss of water.

Mueller service clamps with single or double strap fit main sizes through 12". Clamps are machine-threaded with I.P. or Mueller thread to receive Mueller corporation stops with a wide variety of outlets.

Contact your Mueller Representative or write direct for complete information.



"D-4" Drilling Machine
Drills ⅝" through 2"
Length of travel 14"
"O" ring boring bar seals

"E-4" Drilling Machine
Drills ¼" through 1"
Length of travel 9⅞"
"O" ring boring bar seals

MUELLER CO.
Dependable Since 1857
MAIN OFFICE & FACTORY DECATUR, ILLINOIS

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

New Equipment

Lime Slaker

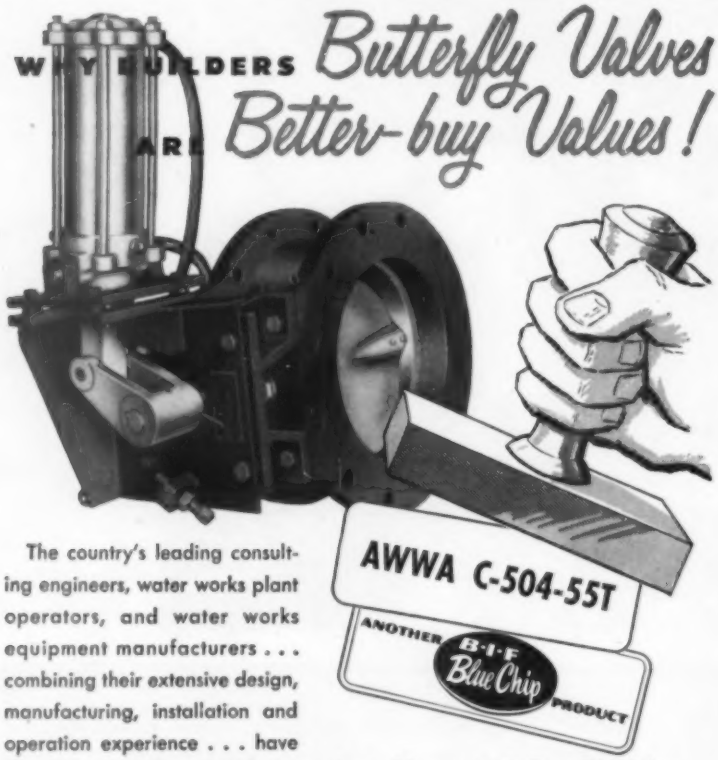
1001

Infilco Inc., Tucson, Ariz., has developed the "Viscomatic" Lime Slaker which departs entirely from any slaker now available. This equipment uses cold water and slakes quicklime in the form of a paste, rather than a slurry.

By slaking as a paste, far more efficient lime slaking is accomplished since all the heat generated is used. Savings of lime up to 30% have been reported from actual field operation. Even poorer grades of quicklime may be used.

Additional advantages of the "viscomatic" lime slaker are: It eliminates inherent deficiencies of past and present slakers by not requiring the use of insulation, heat exchangers, high speed mixers, blender valves or hot water; Saves space—it is smaller than the conventional slakers; The grit conveyor is completely removable for servicing in the event of a breakdown; The slaking tank is designed for very easy cleaning, and flushing out when required; All paddles are constructed of abrasion-resistant materials having long life; and The height of this slaker in all sizes allows direct access to the slaker top from the operating floor. The grit conveyor can be placed in a sump.

WHY BUILDERS ARE Butterfly Valves Better-buy Values!



AWWA C-504-55T

ANOTHER B-I-F Blue Chip PRODUCT

The country's leading consulting engineers, water works plant operators, and water works equipment manufacturers . . . combining their extensive design, manufacturing, installation and operation experience . . . have prepared exacting specifications for rubber-seated Butterfly Valves. BUILDERS-PROVIDENCE Butterfly Valves conform to these specifications and offer the following superior features:

- √ Extra-rugged body construction.
- √ Extra large diameter, stainless steel shafts.
- √ Heavier, larger, longer bearings reduce unit bearing load.
- √ Heavier, sturdier vanes.
- √ Operators matched to valve . . . to meet job torque requirements and *minimum AWWA Specs.*

Builders Butterfly Valves fully comply with AWWA STANDARDS to make them BETTER-BUY VALUES. Request Bulletin 650-L1. Write to BUILDERS-PROVIDENCE, INC., 350 Harris Ave., Providence 1, R. I. . . . division of

B-I-F INDUSTRIES
PROVIDENCE, RHODE ISLAND
METERS FEEDERS CONTROLS

BUILDERS-PROVIDENCE, INC. • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

Large Pipe Centrifugally Spun With Coal Tar Lining

1002

Pipe Linings, Inc., Wilmington, California, recently completed one of the largest centrifugally spun coal tar lining projects ever attempted on large pipe.

100,000 interior square feet of pipe, in sizes from 84″ to 108″ in diameter—40 ft. in length—each section weighing up to 31 tons—was given an interior coal tar coating with mirror smooth finish, using specially designed centrifugal spinning equipment. Other unique equipment permitted the simultaneous sand blasting of pipe exteriors and interiors prior to coating.

Water Weed and Algae Control

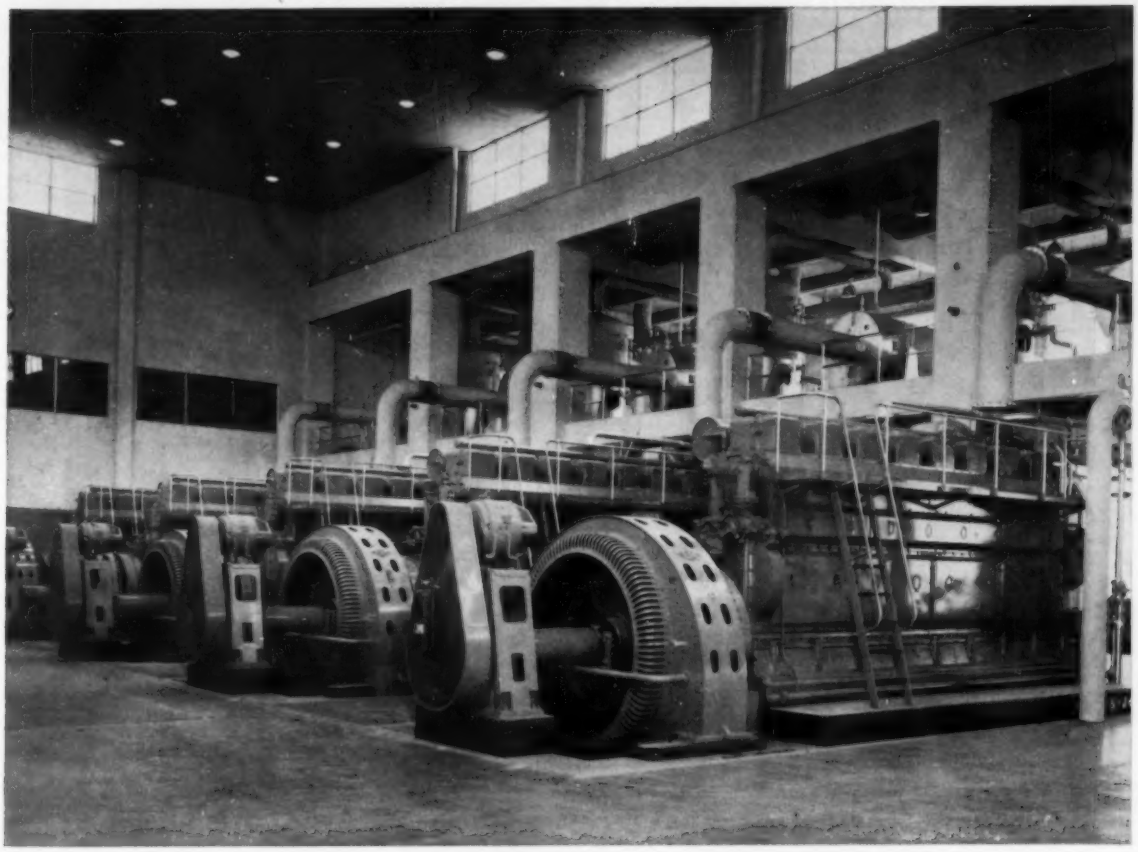
1003

Chipman Chemical Company, Bound Brook, N. J., has available a variety of special chemicals for ridding ponds and lakes of the common types of aquatic weeds and algae.

The chemicals handled by the company include Atlas "A", rec-

(*Continued on page* 102*A*)

"One of the most outstanding operational records in sewage treatment and engine operation" reports Diesel Progress about the Hyperion Activated Sludge Plant of the City of Los Angeles.



10 Worthington engines chalk up 293,899 hours and not one ring, liner, or bearing wore out!

ENGINE	OPERATING HOURS
No. 1	28,928
No. 2	31,163
No. 3	26,926
No. 4	30,422
No. 5	25,648
No. 6	34,472
No. 7	38,367
No. 8	33,785
No. 9	33,753
No. 10*	10,435

*Installed Oct., 1954

In six years of operation, the nine original Worthington engines averaged over 31,000 hours each.

Operating on methane produced in Hyperion's digestion facility, the Worthington engines are turbocharged dual-fuel units rated at 1688 hp each. In six years the ten engines have run 293,899 hours without wearing out a piston ring, cylinder liner, or bearing.

No. 7 Good for 100,000 Hours

Engine No. 7, first on the line, is typical. This engine has 38,367 hours on its original rings. After a routine overhaul, Hyperion engineers predicted a life of 100,000 hours —equivalent to 11 years of continuous operation—per set of rings. They expect double this life for the cylinder liners.

Good Operation

Of course, the finest piece of equipment would not give such an outstanding record without careful attention to such items as lubrication, clean fuel, temperature control, etc. Good operation is the watchword at Hyperion and annual overhauls, including checking of all operating parts, back up the high quality of the Worthington equipment.

Full Report Available

If you would like a reprint of "Hyperion's Six Years of Operation," an interesting article about the plant and its many maintenance innovations, please write to Section W63, Worthington Corporation, Harrison, N. J. Ask for Bulletin RP-928. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont. W.6.3

WORTHINGTON

SEE US AT THE SEWAGE SHOW, STATLER HOTEL, LOS ANGELES, OCTOBER 8-11

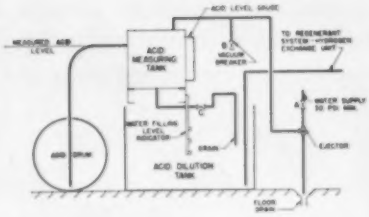
ommended for killing many kinds of water weeds and certain algae; Delrad, which is particularly effective against pond scum algae; and Phygon XL which is used for controlling "pea soup" or bloom producing blue-green algae.

Safe Acid Handling System

1004

Graver Water Conditioning Co., New York, N. Y., had developed a method of acid handling which is of importance to plants using acid in carboys and drums.

Known as the Graver Vacuum



Acid Handling System, it enables the transfer, measurement and dilution of acid to be accomplished without the necessity of lifting carboys or drums and without subjecting any vessels to positive pressures.

Only a water line need be added to the system as furnished. The acid is drawn from the drum or carboy to the measuring tank by the vacuum created by the water operated ejector. When the proper amount of acid is in the tank, the flow is stopped by merely opening a vacuum breaker. Excess acid draws back to supply source. After dilution tank is filled with water, the measured acid is drained into the dilution tank. The proper amount and concentration of acid is then ready for use in the system.

Clow-Strickler Pipe Cutters Now Manufactured By E. H. Wachs

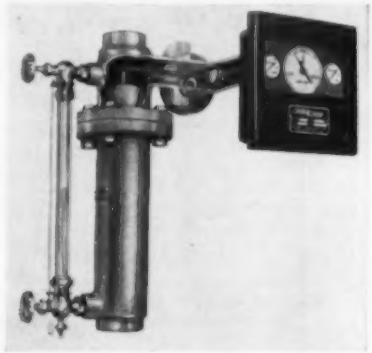
1005

The E. H. Wachs Co., Chicago, Ill., has announced that the entire line of Clow-Strickler hand-operated ratchet action pipe cutters has been purchased from James B. Clow & Sons.

Wachs will continue to build and service all five sizes under the names of Wachs-Strickler cutters, ranging in capacity from 2½ up to 24 inches and will maintain a complete inventory of replacement parts and blades.

Displacement-Type Level Controller

1006



Kieley & Mueller, Inc., Middletown, N. Y., has developed a displacement-type liquid level controller that eliminates both bearings and knife edges, and provides an extremely trouble-free controller for all services.

Called the Flexotrol Liquid Level Controller, the new design introduces a torque table which replaces pivoting members. The face of the torque table, engaging and

(*Continued on page* 104*A*)

PATIENT: 5 miles of 62" and 36" steel water mains in St. Louis, Missouri.

SYMPTOMS: Leakage repair costs on the increase from 1936 to 1947.

DIAGNOSIS: External corrosion causing pitting through the pipe wall.

TREATMENT: In 1947, after consultation with Centriline, pipelines were cleaned and cement-lined in place with a smooth, dense mortar lining by the Centriline Process.

RESULTS: The dense cement lining stopped leakage, eliminating high maintenance costs. Savings represented 13% return on the cost of cleaning and lining.*

This lining has paid for itself in only 8 years. Not only was the leakage stopped but the carrying capacity was increased. If your problem is leakage in steel pipe . . . or capacity reducing tuberculation in steel or cast iron water mains, consider the advantages of cement lining in place.

*From a paper written by Mr. John B. Dean, Division Engineer, Water Div., St. Louis, Mo.

CENTRILINE CORPORATION

A subsidiary of the Raymond Concrete Pile Company

140 Cedar Street, New York 6, N. Y.
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Branch Offices in Principal Cities of the United States, Canada and Latin America

Plastic Coating Stops Costly Condensation Drip and Rust

THE COSTLY PROBLEM caused by dripping from this sweating pipe was permanently solved with one easy and inexpensive application of NoDrip Plastic Coating. Sweating pipes, ceilings, air ducts and other metal equipment are also completely protected against rust and corrosion by low cost NoDrip.

NoDrip Plastic Coating acts immediately to insulate and protect. One application adds many years of service life to metal equipment. NoDrip is also resistant to acid, alkali and brine...protects concrete, brick, plaster, tile wood or composition surfaces.

Easy application requires no special equipment or skill. Anyone can apply NoDrip with brush, trowel or spray. Stop your condensation problem now! Get full details without delay.

JW **Mortell** COMPANY

FREE

32-PAGE NoDrip DATA HANDBOOK

Complete with photographs, charts and technical information to solve your condensation problem. Write today.

Available at leading plumbing and mill supply houses

J. W. MORTELL CO., 599-J Burch St., Kankakee, Ill.

Please send my FREE copy of the NoDrip Data Handbook.

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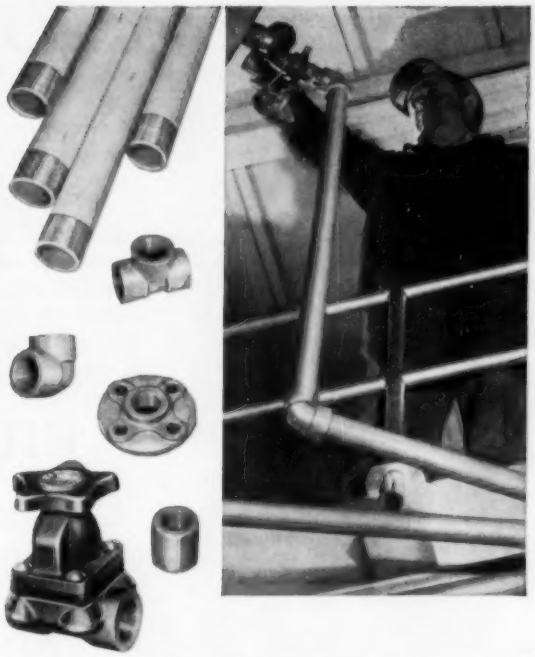


Peak Performance by *Van-Cor* PIPING

An Ohio plant was faced with high pipe maintenance costs because the acetic acid produced is strong enough to eat holes in steel. Instead they installed Van-Cor plastic piping that is still good as new after 18 months' service.

Van-Cor pipe, fittings and valves have solved similar problems with scores of corrosive chemicals. An unplasticized polyvinyl chloride, Van-Cor weighs less, and is easier to install, than conventional piping. It serves longer, thus costs far less . . . Van-Cor sheets are also fabricated into ducts, hoods, tanks, fumestacks, etc.

INVESTIGATE!

Write for Bulletin, Specifications and Name of Nearest Distributor.

INDUSTRIAL DIVISION OF

COLONIAL PLASTICS MFG. CO.

SUBSIDIARY OF THE VAN DORN IRON WORKS CO.

2685 EAST 79th STREET • CLEVELAND 4, OHIO

driving the torque tube is free to twist under the action of the displacer. Since there is no dependence on sharp edges, performance of the controller is essentially constant and normal process residues do not hamper operation. Control action is interchangable for proportional or differential gap response and proportional band is 1 to 150% with automatic reset as an extra feature.

Pipe Shop On Wheels

1007

Beaver Pipe Tools, Inc., Warren, Ohio, has just put a new pipe tool unit on the market that combines the No. 20 Beaver "Speed-Cut" Abrasive cutting machine and the newly-remodeled Model-A Pipe and bolt machine on a pneumatic-tired trailer.

The unit can be hauled by car, truck or jeep right to the work site. There is plenty of accessory storage.

The abrasive cutting head is powered with a 8.3 h.p. Wisconsin gas engine or with a 5, 7½ or 10 h.p. 220/440 volt, 60 cycle, three phase motor. The model-A pipe and bolt machine is powered with a 110 or 220 volt universal single phase 25 to 60 cycle motor. A 220/440 volt, three phase, 60 cycle motor or a 2500 watt D.C. generator with extra outlets for small electric tools are also available.

Compact Variable Speed Motor

1008

U. S. Electrical Motors, Inc. Los Angeles, Calif., has developed a new variable speed, internally-geared Varidrive motor, with take-off shaft and motor on the same side. The new motor is ideal for low-speed applications requiring variable speed, where weight distribution and limited space is a factor.

The new units are available up through 5 HP. Both upright and horizontal assemblies are on production with either dripproof, totally-enclosed or explosion-proof motors. Extremely compact, these Varidrives provide very slow speeds and high torque, without resorting to the use of separate gear boxes, speed changers, extra couplings, guards, and other extraneous material.

Liquid Neoprene For Protective Coating

1009

The Wilbur & Williams Company, Boston, Mass., in conjunction with the Du Pont Company,

HIGH QUALITY HYDRANT

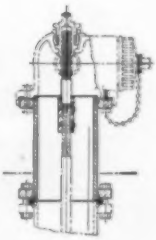
The R. D. Wood Standard Swivel Joint Hydrant with or without breakable flange and stem coupling

All Bronze Stuffing Box

Sound and simple in construction. It cannot rust or corrode. Hydrant operating thread can be greased or oiled by unscrewing one small plug.

Extension Piece

Can be inserted between hydrant head and barrel or between barrel and elbow. Installation does not require shutting off water supply.



R. D. WOOD

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

has developed a Neoprene coating in a liquid form suitable for brushing or spraying. This new product also eliminates the necessity of watching the shelf-life of the liquid Neoprene.

Called Rubber-Coat Liquid Neoprene, it is available in clear, black, red, light gray, and aluminum. With all of the protective features of Neoprene retained, Rubber-Coat will find particular application to structural steel shapes, pipe, and irregular areas.

New Machine Cuts Clay Pipe Manufacturing Costs

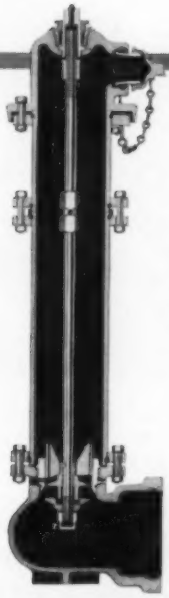
1010

Denver Brick & Pipe Co., Denver, Colo., has installed a new continuous operation, automatic pipe machine, combined with tunnel kiln curing and baking.

The new machine in addition to cutting manufacturing costs, makes possible the reduction of joints by manufacturing 8-inch pipe in 4-foot lengths. Sewer pipe can now be ready for delivery in five days, compared with 15 days previously required.

AT LOWEST COST

The R. D. Wood Standard Swivel Joint Hydrant is designed to provide maximum strength and reliability at lowest possible cost. Internal friction, which can lower pressure, is reduced to the minimum, well below A.W.W.A. specifications. Changes of diameter are carefully rounded and nozzleways are scientifically tapered.



Breakable Flange and Stem Coupling

Available at slight additional cost are this specially designed flange in the standpipe and a frangible coupling in the hydrant stem. A heavy blow that would ordinarily break the hydrant will snap the ring in the flange and the coupling in the stem. Both can be replaced quickly and inexpensively. No digging is necessary.

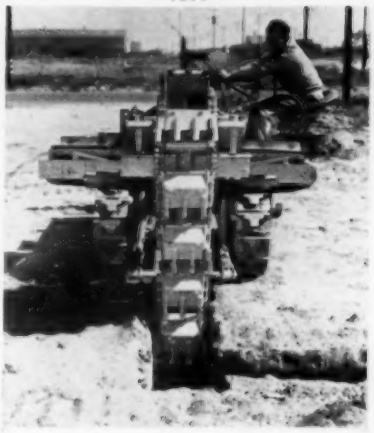
Exterior views showing breakable swivel flange and head with steamer nozzle and two hose connections. Available with standard types of pipe connections—bell, *mechanical joint*, flange, universal or screw.

COMPANY

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

Universal Trencher

1011



The Challenge Manufacturing Co., Los Angeles, Calif., and Bryan, Ohio, has announced the purchase of the Heller Mfg. Corp., Los Angeles. Production of the "Universal Trencher" previously manufactured by Heller, has been greatly increased by Challenge Mfg. Co. in order to fill delivery schedules more promptly.

The Challenge "Universal Trencher" is designed solely for "Utility Trenching" . . . hydraulically controlled, its side seat arrangement reduces "Operator Fatigue". It trenches up to a 4 ft. depth and 14", 16" and 18" widths . . . up to 8 digging speeds, safety clutch and hydraulically controlled backfiller blade. The unit digs square corner trenches, cross trenches, holds line and grade without effort . . . fingertip controls switch dirt from side to side without stopping . . . trenches easily in small space and against buildings . . . makes pipeline stripping safe and easy . . . even street asphalt is no problem.

Trencher model No. 3A-48 is designed for mounting on the Oliver OC-3 tractor and Trencher model No. DA-48 mounts on the 40-C and the 420-C John Deere tractor.

Alternating Current Diesel Power Package

1012

Alco Products, Inc., has delivered its first alternating-current diesel-electric power package, a skid-mounted unit for a new incinerator plant.

The package is powered by the new Alco 251-B, 6-cylinder diesel, a light-weight, heavy-duty turbocharged engine designed for both

(*Continued on page* 106*A*)

stationary and portable applications. Also mounted in the package is a 485-kw AC generator with top-mounted, belt-driven excitation. The unit has self-contained lube oil, fuel oil and shell and tube jacket water cooling systems.

The engine-generator set requires only a 20-inch concrete foundation, compared to the six feet or more of concrete required for many units with the same or lower ratings. This lighter weight foundation is made possible by distributing the unit's weight over a large bearing surface, making the unit load under 1,000 lbs. per sq. ft. There is no torque applied to the foundation by the package unit.

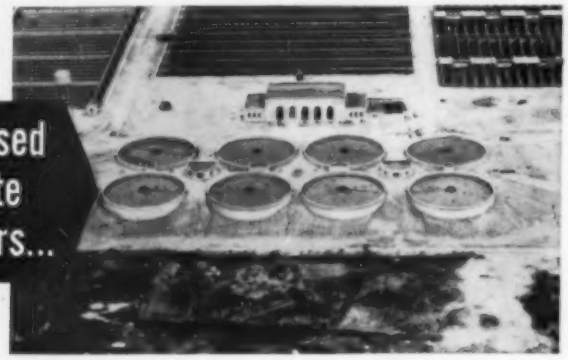
Supervisory Control Systems

1013

Sparton Control Systems Division, The Sparks-Withington Co., Jackson, Mich., has developed new supervisory control systems for remote metering and control of waterworks, well fields, pumping stations, and sewage plants.

A complete line of plug-in packaged units are now available, enabling building block assembly for maximum system flexibility.

The systems employ a variety of techniques for measurement, control, programming and alarming remotely: 1, discreet control and supervision—polarized d.c. pulses, time coding of d.c. pulses, and pulse-tone time coding; 2, continuous proportional control and supervision—polarized d.c. signals, d.c. pulses and continuous d.c. signals; and 3, channel multiplexing—flip-flop, multi-channeling scanning and multiplexed tones.



prestressed concrete digesters...

by PRELOAD

TRADE MARK

City of Philadelphia, Penna. North East Sewage Disposal Plant. Eight 110'6" inside diameter x 32' high Digesters.

- Economical First Cost
- Maintenance Free
- Long Life Expectancy
- Architecturally Pleasing
- Big Jobs . . . Small Jobs

If you are planning for Sludge Digestion Tanks, be sure to check on Prestressed Concrete Digesters. Today's most modern installations take advantage of many economies offered by Prestressed Concrete design.

Send for Bulletin T-7 on SLUDGE DIGESTION TANKS

INTERESTED IN WATER TANKS? Send for Bulletin T-12

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Tel.: Benton 1-7104

HERRICK IRON WORKS
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Bayshore Annex
Oakland, California
Tel.: Glen Court 1-1767

THE PRELOAD COMPANY, INC.
(Southwest District Office)
423 North Manus Drive
Dallas, Texas
Tel.: WHitehall 2-8849

Slip-On Caps Prevent Internal Corrosion of Stored Pipe

1014

Protokap, Inc., Houston, Texas, has developed slip-over and roll-on end caps of neoprene that effectively seal out air, moisture, corrosive fumes, etc. from stored pipe and tubing.

By simply adding a small amount of dehydrating agent before slipping on the easily fitted caps, the pipe is protected from corrosion, drying of thread dope is retarded, and theads are kept free of sand and grit.

Two types are currently available: a lightweight roll-on cap for pipe 2 to 10 inches in diameter; and a heavier, slip-on cap for 2 to 20 inch diameter piping. Because they are made of neoprene, the new end caps will stand up to rough handling and repeated reuse.

High-Stability Wide-Band Pneumatic Controller

1015

The Bristol Co., Waterbury, Conn., has developed a new air controller that features high sta-

bility of control action without loss of sensitivity, coupled with a wide proportional band.

Among the design features of the new controller are wide proportional band width with easy shift in width, full zero derivative settling on triple mode controller, reset action stops for prolonged deviation from set point under severe load changes, easy reversal of action, and a precision linkage arrangement allowing complete disassembly and recalibration with only one adjustment.

Computing Telemetering System

1016

The Bristol Co., Waterbury, Conn., has developed a new system of telemetering instruments which will totalize several flow measurements, correct for such factors as temperature, pressure, specific gravity and supercompressibility in fluids, and will provide a corrected flow value.

The computing systems are built up to fit a specific set of requirements from standard Bristol Metameter measuring transmitters. In a typical system, indicating or recording telemeter receivers retransmit the uncorrected flow values to a totalizing electronic instrument. At this stage, corrections for static pressure, temperature and specific gravity are made, either by signals from other Metameter transmitters or by manual settings, and the corrected total is recorded and integrated if desired.

Six Scale Pipe Fittings Template

1017

A. Lawrence Karp, Greenwich, Conn., has available a template that condenses the most commonly used pipe fittings symbols onto a single template along with two imprinted tables that permit the user to transpose quickly in six different scales.

On this 5¼ X 8 inch condensed version, 91 symbol aperatures have been cut through rigid transparent Vinylite with professional regard for accuracy, dimensional stability and pencil tolerances. A wide range of commonly used symbols for O/D pipe, end bells, flanges and fittings is covered. Foreshortened views are included. Printed tables relate the symbols to ⅛, ¼, ½, 3/16, ⅜, and ¾ inch scales.

Only DeZurik

MAKES THE

EASY-OPERATING PLUG VALVES

THAT NEED NO LUBRICATION

EXCLUSIVE ECCENTRIC ACTION

Only DeZurik Valves are designed with Eccentric Action which *guarantees* easy operation and tight closure. The plug contacts the valve seat only when the valve is closed; opening the valve swings the plug away from the seat and it turns easily—without friction, without binding, without lubrication!

- EASY OPERATION WITHOUT LUBRICATION
- ON ALL LINES FROM HEAVY SLUDGE TO GAS
- RESILIENT-FACED PLUG SEALS TIGHT DESPITE SOLIDS IN THE FLOW
- A QUARTER-TURN FROM WIDE OPEN TO DEAD SHUT
- NO CONTINUAL, COSTLY MAINTENANCE

The valves pictured above are on suction lines from the clarifloccculators in the Municipal Sewage Plant at St. Cloud, Minnesota (City Engineer, Richard Teague; Consulting Engineers, Buehl and Winters, Sioux City, Iowa; Contractor, Al Johnson Construction Co., Minneapolis). DeZurik Valves are used throughout this modern plant; on raw sewage, raw sludge, treated sewage, sewage gas, digested sludge beds, final effluent. Write for complete details on DeZurik Valves. Representatives in all principal cities.

DeZURIK SHOWER CO.

Sartell, Minnesota

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Well Driller

1018

Consolidated Industries, Inc., West Cheshire, Conn., has announced that their Con-Sol Well Driller is now being manufactured and distributed by the National Welding and Manufacturing Co., of Newington, Conn., under the name of the National Well Driller.

Sturdily built of structural steel, the National well driller weighs only 450 pounds and uses 4-inch casing in easy-to-handle 4-5 foot lengths. Only 8 feet of headroom is required and power is supplied by a ¾ hp electric motor of a 1½ hp gasoline motor. Simple and complete instructions are furnished with every machine. A larger model using a 6-inch casing is also available.

Vertical Solid Shaft Motor

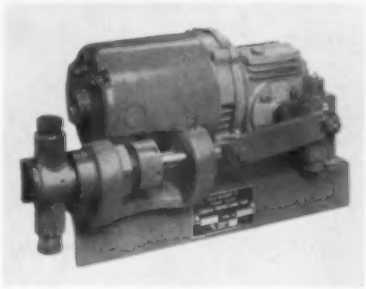
1019

U. S. Electrical Motors Inc., Los Angeles, Calif., has announced a newly designed vertical solid shaft motor, conforming to dimensional standards recently adopted by NEMA.

Designated as U. S. Uniclosed, Type HV, this new motor is more compact than previous motors for its horsepower rating. The new motors are available in from 1 to 10 hp. and will soon be available up to 30 hp. Type HV vertical shaft connection for directly applied power simplifies hookup and unitizes the motor with the driven machine. This insures positive alignment and quiet operation.

Chemical Feed Pump

1020



Hills-McCanna Co., Chicago, Ill., has developed a new chemical feed pump. A compact and simplified pump, the model 4411 has a maximum capacity of 7 gph/feed and discharge pressures up to 600 psi.

The 4411 was specifically designed for applications requiring a delivery rate of 7 gph/feed or less. Of the positive displacement, plunger type pump, it contains many built in operational features such as "capsulated" construction. This pump is especially suited for applications requiring precision and economy in the continuous feeding of chemicals used in water conditioning, chemical process additive feeding, petroleum inhibitor addition and other similar applications.

Crawler Tractor Backhoe

1021

American Tractor Corp., Churubusco, Ind., has developed a new TerraTrac backhoe, designed and built exclusively for heavy-duty use on TerraTrac crawler tractors.

Developed by TerraTrac engineers, the new unit is said to offer 12 advanced operating and low-maintenance features, with a lower selling price than most smaller capacity wheel-type backhoes currently being "adapted" for use with other manufacturers' tractors.

The streamlined TerraTrac boom, featuring hydraulic "plumbing", is fabricated of heavy steel

INSTALL with a RATCHET WRENCH

Any type and size of M & H Valve or Hydrant can be furnished with standardized Mechanical Joint end connections, to fit mechanical joint pipe and fittings made by different manufacturers.

The use of Mechanical Joints has spread steadily for 40 years until today it is more widely used than any other type of joint because it offers many advantages. M & H Mechanical Joint Valves and Hydrants are used not only with mechanical joint pipe but are easily installed in old bell-and-spigot pipe lines.

The joint is made by a bolted gland compressing a thick gasket into a stuffing box. The joint assembly is simple, rapid and practically foolproof. The gasket used for water mains is composition rubber, but metal-tipped, duck-tipped, Thiokol-tipped and other special gaskets can be supplied. The joint is bottle tight, and permits deflection, expansion or contraction without leakage. Write or wire

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

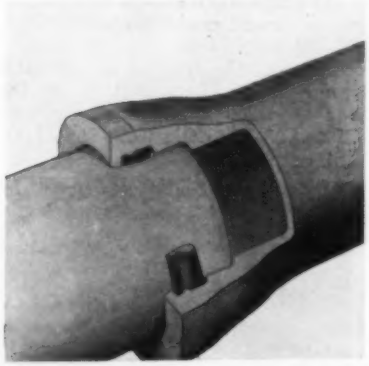
plate, and is said to have a lifting capacity of 3000 lbs. for handling pipe, etc. The new unit digs 12½ ft. deep, has a reach of 18 ft., and a clear dumping height of 13 ft. A bucket rollback of 90°, controlled by an extra large hydraulic pump, insures heaped loads without spilling. Buckets from 17" to 24" wide are currently available.

One of the outstanding new features claimed by the manufacturer is a full 180° boom-swing with hydraulic foot-pedal control, which is said to speed up cycle-time and greatly simplify operation, because it leaves the operator's hands free to maneuver the boom and bucket while swinging.

New Cast Iron Pipe Joint

1022

United States Pipe and Foundry Company, Birmingham, Ala., has developed and is now making cast iron pipe with its new Tyton Joint.



The Tyton Joint has only one accessory—a circular rubber gasket. This gasket is modified bulb shape in cross section. Composition and dimensions of the gasket have been carefully determined to assure a tight and lasting seal.

The inside contour of the bell or socket provides a seat for the gasket. An internal bead in the socket fits into the groove in the gasket.

The gasket is placed in the socket, its inside surface is given a light coating of lubricant and then the slightly tapered plain end of the joining pipe is simply forced into and seated in the socket. The gasket is compressed by the plain end and the joint is made up.

Gasoline Electric Plants

1023

Gen-A-Matic Corp., Van Nuys, Calif., has announced the addition of two new groups of gasoline

(*Continued on page* 110*A*)

CHEMICALS YOU LIVE BY

Diamond Chlorine

Conveniently Located Chlorine Plants

Looking for a reliable chlorine producer that can back you up in emergencies? Call DIAMOND ALKALI.

We are equipped to give you fast service from five conveniently located plants as well as technical help from one of the world's greatest stores of chlorine know-how.

Call your nearest DIAMOND sales office or plant for regular or emergency shipments.

FREE! CHLORINE SAFE-HANDLING WALL CHART

DIAMOND ALKALI's years of know-how have been compressed into this chlorine safe-handling wall chart. Hang it where workers can read it. Copies free. Ask your DIAMOND sales office or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

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electric plants to its line of generators.

Both air and water-cooled models, with ratings from 400 to 75,000 watts, are now available, as well as three separate lines of Diesel electric plants.

The portable electric plants, ranging from 850 to 5,000 watts, and the Group II plants currently being introduced are available with automatic and semi-automatic control apparatus for special applications and any desired control configuration may be specified.

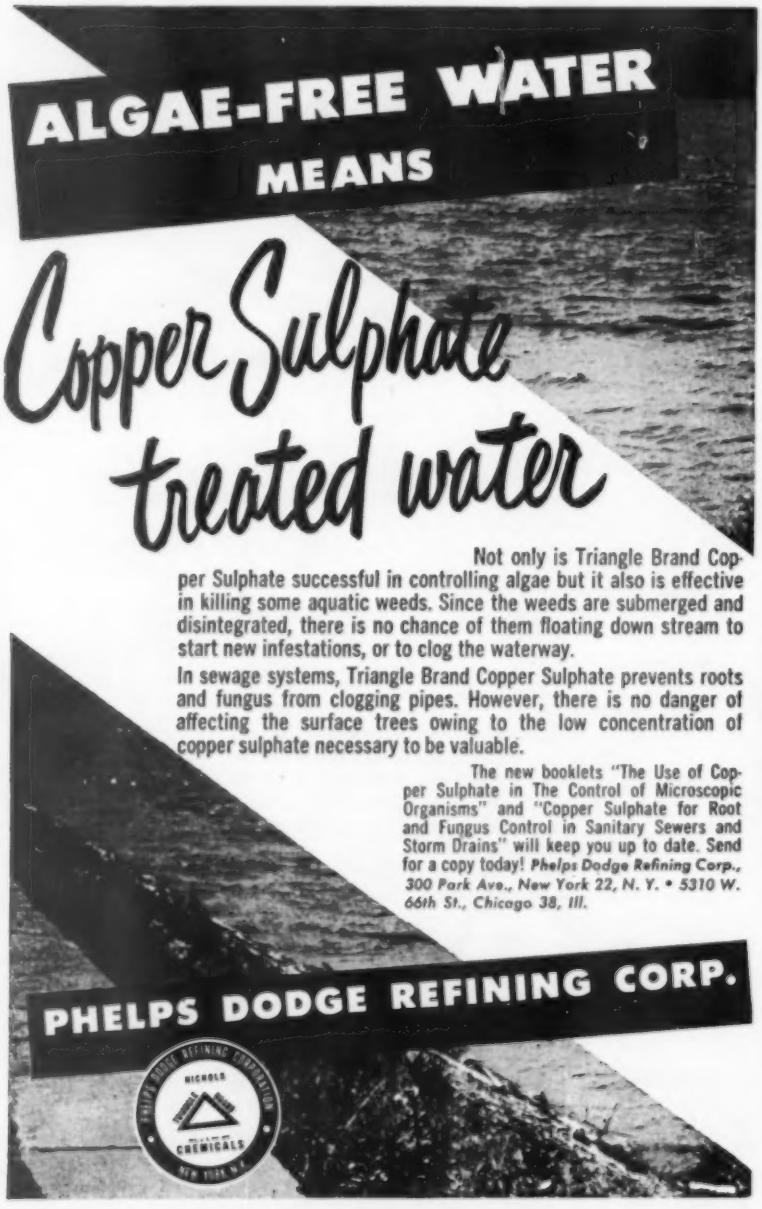
One Man Power Tool Grinds All Size Valves in Line

1024

The Leavitt Machine Co., Orange, Mass., has available the Motor-Driven Dexter Valve Reseating Grinder that can regrind any globe or gate valve from ¼ to 12 inches without removing the valve from the line.

Through the use of a new high speed motor and recently developed abrasive cloth grinding elements, the new machine can grind the seat of any valve regardless of material hardness. The grinding elements, made in form of cones and segments, are mounted on various size rubber coated grinding heads. By changing these grinding heads, the same machine can be used on various size valves.

Using only one man, the precision build machine guarantees accuracy be refacing irregular valve seats from the same "reference Point" that was used by the manufacturer in machining the original seat. Strict adherence to the original "reference point" makes the reground valve as tight as new.


ALGAE-FREE WATER
MEANS
Copper Sulphate
treated water
Not only is Triangle Brand Copper Sulphate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulphate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulphate necessary to be valuable.
The new booklets "The Use of Copper Sulphate in The Control of Microscopic Organisms" and "Copper Sulphate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y. • 5310 W. 66th St., Chicago 38, Ill.
PHELPS DODGE REFINING CORP.
NICHOLS
CHEMICALS

Elevated Tank Features Tripod Tower

1025

Chicago Bridge & Iron Co., Chicago, Ill., has developed an all-welded, economy-model elevated water storage tank utilizing a modern, fuctional tripod design.

The new tank is available in relatively small capacities only—from 15,000 to 75,000 gal. Standard heights to the bottom of the tank range from 25 to 100 ft. in the 15,000 to 30,000 gal. capacities and 25 to 125 ft. in the 40,000 to 75,000 gal. capacities.

The tripod tank, offers all the advantages, including easy maintenance, of an all-welded design. Cost of the tripod structure runs considerably less than for ellipsoidal or hemispherical. tanks of equal capacity.

New Type Switch For Level Detection

1026

Automation Products, Inc., Houston, Texas, has developed a different type of control for the

detection of fluid levels.

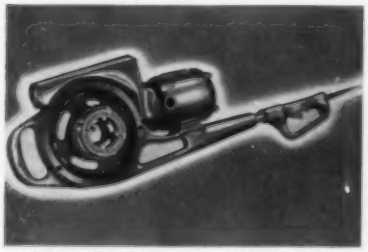
Called the "Dynatrol", it consists of a "Motor-Generator" driven at resonant frequency by an

alternating current input. The output of the generator energizes a rugged relay to control the operation of any type of electrical equipment. For high level detection, the generator output ceases as a result of the fluid rising and stopping the vibrating paddle, thereby causing de-energization of the control relay. For low level detection, the generator output energizes a control relay when fluid level drops and allows the paddle to vibrate. The control is sensitive only to level variations and is accurate to .01 inch.

Improved Power Drive For Pipe Threader

1027

The Toledo, Pipe Threading Machine Co., Toledo, Ohio, has developed a new improved power drive. Known as the Toledo No. 68, this portable power drive has been completely redesigned for easier operation and longer life.



According to the manufacturer, the new streamlined frame is slightly heavier and more sturdy. New ball bearing design improves service life and minimizes periodic maintenance. The unit is easier to hold and safer to operate because of a new handle design and relocation of the control switch to a convenient position on the handle. The trailing wire is located out of the way of the operator and offered in either painted finish or highly pol-

(*Continued on page* 112*A*)

E. R. P. CATHODIC PROTECTION . . .
individually designed for each application

An effective installation that operates at the lowest cost per year requires experienced engineering evaluation of site and environmental conditions. The Electro Rust-Proofing Engineering Division makes available to you the cumulative experience gained in designing more than 10,000 cathodic protection systems.

Electro Rust-Proofing can furnish any one, or all, of the following services to help you provide proper cathodic protection for each of your jobs:

- Corrosion surveys and recommendations
- Design based on engineering experience
- Cathodic protection equipment and installation
- Service to assure proper operating results

For additional information write today.

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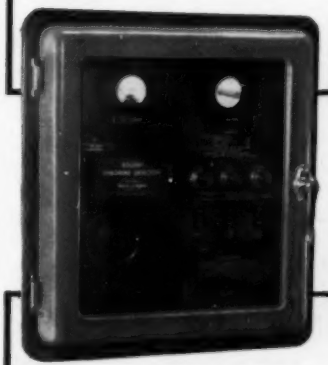
E-35R



HOW TO DETECT 3 PARTS CHLORINE IN A MILLION PARTS AIR

New W&T Solvay Chlorine Detector*
detects as little as 3 p.p.m. chlorine in a continuous air-stream sample. Automatically sets off alarm at higher concentrations.

Write for Publication 50.118

WALLACE & TIERNAN
INCORPORATED
25 MAIN ST., BELLEVILLE 9, N. J.

I-55 *Manufactured under patent license from Solvay Process Div., Allied Chemical & Dye Corp.

Spiragester, Aero-filter and Final Spiraflo Clarifier
West Columbia, Texas

The Spiragester is efficient, easy to operate and maintain, and is not offensive to the eye or nose.

For an economical Spiragester plant design, see Fig. 19, Lakeside's Bulletin 135.

Visit booths 37 and 38 at the Oct. 8-11th Annual Meeting of the Federation of Sewage and Industrial Wastes Associations, at the Statler Hotel in Los Angeles, and see the Plastic Model of the Spiragester.

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SPARLING MAIN-LINE WATER METERS have long been a standard of engineers and superintendents seeking the finest equipment at a moderate price.

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KANSAS CITY 6, MO.	6 E. Eleventh St.	248 London Rd.	ROMFORD, ENGLAND

ished aluminum finish. Adaptors for most standard die stocks, as well as square socket adaptors, add to its versatility. The No. 68, powered by a 115 volt reversible AC or DC motor or 90 psi air motor, weighs only 33 lbs.

Chlorine Detector

1028

Wallace & Tiernan Inc., Belleville, N. J., has developed a new instrument for detecting as low as 3 ppm chlorine gas in the atmosphere.

The Wallace & Tiernan Solvay chlorine detector monitors a continuous controlled sample of air, warning when chlorine concentrations in the air exceed 3 ppm. Thus, the sensitivity of the detector allows the unit to give a warning of the presence of chlorine in the air long before a concentration of 15 ppm is present that would cause throat irritation.

The detector is electrically operated with the alarm signal resulting from the reaction of chlorine gas with a chemically treated dry paper. The unit is made for either wall or panel mounting. It can be used wherever chlorine gas is used or stored.

"There is hardly anything in the world that some manufacturer can not make—a little worse and sell a little cheaper than a competitor. Those who buy—on price primarily are that purveyor's lawful prey"—*Ruskin.*

Ed. Note: The law of the land is still *Caveat emptor*", which is to say "let the buyer beware."

W & SW Manufacturers' News

U.S. Pipe Promotes Madden

United States Pipe and Foundry Company, Birmingham, Ala., has announced that John Madden, Jr. has been appointed Sales Agent in charge of the New York Office succeeding George T. Overholt who retired on September 1.

Mr. Madden is a graduate of Yale University. Following his graduation he spent two years as a commissioned officer in the Marine Corps. Mr. Madden came with U. S. Pipe in 1953 and was connected with the Burlington sales office until his transfer to New York in April of this year.

Johns-Manville To Build New Transite Pipe Plant in Texas

Johns-Manville Corp., New York, N. Y., has announced that construction will soon be started on another new Transite asbestos-cement pipe plant to be located at Denison, Texas.

It is anticipated that about 270 people will be employed at the Denison plant with an annual payroll of over $1,200,000. Production, curing, storage and shipping facilities will cover 350,000 square feet located on a 400-acre tract of land near Denison.

The plant will be Johns-Manville's second plant in Texas and will service the states of Texas, Oklahoma, New Mexico and Arkansas.

Byron Jackson Promotes Three

Byron Jackson Pumps, Inc., Los Angeles, Calif., has announced new appointments for three men.

R. A. Winsryg has been appointed regional manager of the Los Angeles region. He previously served as manager of the Houston region.

E. L. Lindsey has taken over as regional manager of the Houston area. He formerly held the position of Los Angeles regional manager.

Dean De Graffenreid has been appointed assistant regional manager at Houston to aid Mr. Lindsey. Prior to this, Mr. De Graffenreid served as assistant to Mr. Robert Harcus, executive vice-president.

how to CUT CORROSION LOSSES

a report by Koppers Company, Inc.

C. U. Pittman
Supervisor Technical Services

Good surface preparation is basic to the life and effectiveness of protective coatings. Without it, the coating cannot bond properly and may fail to prevent future corrosion.

The surface preparation method selected depends on the type of surface, the degree of corrosion, contaminants present, the desired life of the coating and the physical accessibility of the surfaces to be coated.

* * *

To remove all traces of grease or oil, vapor degreasing or solvent cleaning is necessary *before* mechanical surface preparation. Acid cleaning or pickling to remove rust and mill scale is fast and usually low in cost. After treatment, the acid should be neutralized immediately.

Hand cleaning is recommended only on small jobs, or where areas are not easily accessible. The main problem in using chisels and pointed scrapers is to avoid high ridges which cause thin spots or holidays in the coating. Power brushing and scraping are two of the more common methods of preparing surfaces. For removing rust, they are both quite effective and, usually, reasonable in cost. We have found, though, that power brushing frequently polishes surfaces too much.

Flame cleaning is a good way to remove old coatings and to heat surfaces prior to applying a thermoplastic coating. Flame cleaners are also very good for drying damp surfaces. By creating thermal shock, flamers are an effective—though slow—way to remove mill scale. Surfaces should always be wire-brushed after flame cleaning.

Blast cleaning with sand or grit has proved to be the best way to remove incrustation, rust and mill scale, and is more economical than is generally realized. Blasting is fast on even the most irregular objects. Good practice leaves the surface free of high peaks, but with shallow valleys that make good "anchors" for the coating. Care should be exercised that the air used in blasting is free of oil. Coatings should be applied immediately after blasting or the surface should be primed quickly with WP-1, two compartment type wash primer. WP-1 should also be applied if the cleaned surface cannot be completely dried.

* * *

Concrete and masonry surfaces are prepared best by hand cleaning, power brushing or chemical cleaning. Brushed surfaces should be blown clean with oil-free air, and chemical cleaners should always be neutralized, or removed by flushing, immediately. Patching and repair work should be prepared in the same manner as the original surface.

* * *

The extra care and investment in thorough surface preparation always pay dividends in effective, long-lasting corrosion protection.

Your corrosion problems are our business. If you have any questions on which you'd like assistance, write: Koppers Company, Inc., 1301 Koppers Building, Dept. 109K, Pittsburgh 19, Pa. District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario and Edmonton, Alberta.

KOPPERS

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REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

T-LOCK SEWER LINING PREVENTS HYDROGEN SULFIDE ATTACK...
millions of square feet now in use!

Armco To Build New Plant In Denver

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has announced plans to build a new $550,000 fabricating plant in Denver Colorado.

The construction of the plant is scheduled to begin immediately and should be completed by the end of the year. It will be located on a 15-acre site on Colorado Boulevard.

The new plant will produce corrugated pipe and pipe arch, metal flumes, head gates, sluice gates, sewage gates, and water control gates. It will also have facilities for converting corrugated metal pipe to the company's new Smooth-Flo sewer pipe and for paving and coating pipe with asphalt.

Armco Drainage recently purchased the gate producing facilities of the Pekrul Gate Division of the Morse Brothers Machinery Co. of Denver, and this addition will round out the water and sewage gate production of the company.

R. S. Rankin Retires; F. G. Nelson Promoted by Dorr-Oliver

Dorr-Oliver Incorporated, Stamford, Conn., has announced the retirement of R. S. Rankin, Director of the Sanitary Technical Division, and the appointment of Fred G. Nelson to this position. Mr. Rankin, long active in the sanitary field, has completed 27 years of service with Dorr-Oliver. He will remain with the company, however, in a consulting capacity on sanitary engineering matters. He will also continue to represent Dorr-Oliver in the various organizations with which he is now associated.

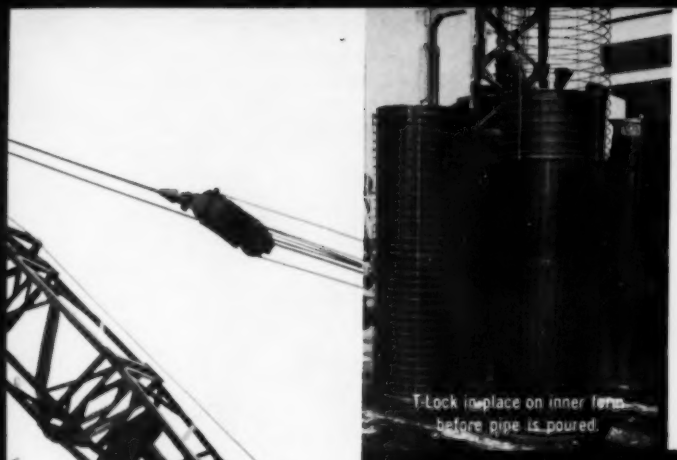
In his new position, Mr. Nelson will have over-all responsibility for the development, design and engineering of all D-O equipment used in the sanitary field. Assistant to Mr. Rankin for a brief period, Mr. Nelson was previously Manager of the Western Sanitary Division at Oakland, Calif. He has been closely associated with water, sewage and industrial wastes treatment operations since joining Dorr-Oliver in 1928.

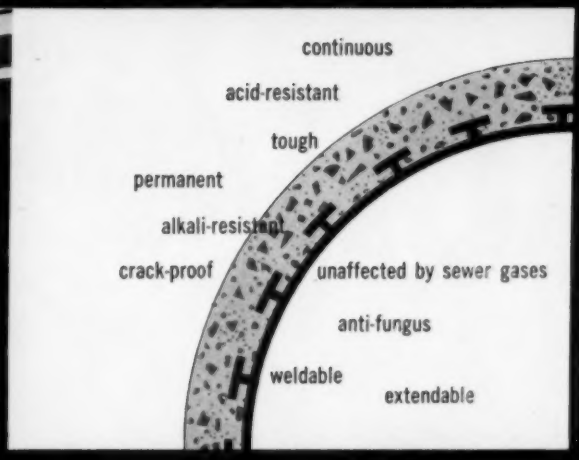
Mr. Nelson is past President of the California Sewage and Industrial Wastes Association and a director of the FS&IWA, representing the State of California. In 1955 he received the California Section's Arthur Bedell Award. Mr. Nelson is also a member of the A.S.C.E. and AWWA.

A-C Names New Managers For Pittsburgh and Charlotte

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced that R. H. Cline, formerly manager of the Charlotte district, has been appointed manager of the Pittsburgh district of the company's Industries Group. He succeeds J. K. Keogh, who continues as a special representative reporting to V. L. Spinney, manager of the Central Region.

Keogh, who started with Allis-Chalmers as an office boy, observed his 50th anniversary with the company in 1954.





T-Lock Amer-Plate permanently ends corrosion in concrete sewer systems—because it is impervious to hydrogen sulfide, other sewer gases, fungus, bacteria, acids, alkalies and salts.

T-Lock is an extremely dense, flexible, crack-proof liner of high polymer vinyl resin. Integral T-shaped ribs are permanently locked into concrete during pouring. Joints are heat-fused to form a continuous protective lining that will not separate from the concrete even under extreme back pressure.

Over 3 million square feet of T-Lock Amer-Plate have been installed in pre-cast, cast-in-place and monolithic sewer structures of all sizes with no sacrifice of structural strength—at costs comparable to earlier lining methods.

Illustrated brochure and list of typical installations on request.

Amercoat®
CORPORATION, Dept. JJ
4809 Firestone Blvd., South Gate, Calif.
Evanston, Ill. • Kenilworth, N.J
Jacksonville, Fla. • Houston, Tex.

Cline, who is succeeded as Charlotte district manager by C. B. Rumble, Jr., joined Allis-Chalmers in 1946 as a representative in the Atlanta district. He was named manager at Charlotte in 1952. He is an electrical engineering graduate of Duke University.

Rumble has been a representative in the Allis-Chalmers Philadelphia district since 1946. He is a mecanical engineering graduate of Purdue University.

Combustion Engineering Promotes Hatfield to General Sales Mgr.

Combustion Engineering Inc., New York, N. Y., has announced that Robert M. Hatfield, has been appointed general sales manager of the company.

Mr. Hatfield, who formerly was vice president of the Western Division of the company, has had his 22-year service with Combustion Engineering interrupted twice for assignments with the government in Washington. During World War II he was on loan to the War Production Board where he progressed to deputy vice chairman for production for all war industries. During the Korean War he organized and headed the Power Equipment Division of the National Production Authority and later became vice chairman of the Munitions Board.

He is an engineering graduate of Purdue University and served as assistant general sales manager and general manager of the Western Division before being elected a vice president in 1952.

"Jim" Parker Representing Ford Meter Box Co. in East

Elsewhere in this issue is a news item on the appointment of Richard V. ("Dick") Ford, Vice-President of Ford Meter Box Co. and Vice President Elect of the W.&S.W. Mfgrs. Assoc., as Director of the Water & Sewage Utilities Div. in the Dept. of Commerce for a six month period of service without compensation.

To assist "Dick" Ford during the period of his loan by Ford Meter Box Co. to the Dept. of Commerce, James R. Parker is being assigned to the company's eastern territory office in Haddonfield, N. J.

Mr. Parker, who hails from Haddonfield incidentally, has completed a training course in the Ford Meter Box Co. factory in Wabash, Ind. He is a graduate of Lafayette College, served a two year stint in the U. S. Army and worked for a Philadelphia bank before joining Ford Meter Box Co. some six months ago.

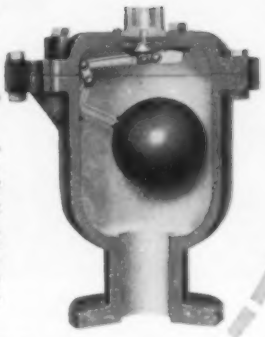
This item and picture will serve as an introduction of young "Jim" Parker to Ford's customers, prospects and friends.

Crispin

NEGATIVE PRESSURE AIR VALVES

Finest insurance against throttled pipelines

Crispin Negative Pressure Air Valves provide automatic or semi - automatic operation of siphons—air escapes but cannot enter line. Simplified design, rugged construction for best operation. Preferred by water works engineers for dependable control of air in pipelines.



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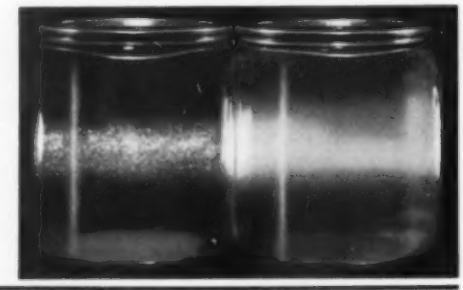
settle water clarification problems

fast

Floc formed by N-Sol Activated Silica Sol and your regular coagulant is large, bulky and strong, settling rapidly to produce clear, sparkling water. Choose the N-Sol Process coagulant aid to fit your operation. No charge for license under N-Sol patents.



PROCESS	REACTANT	ADVANTAGE
N-Sol-A (U.S. Pat. 2,444,774)	Ammonium sulphate	Ease of preparation, either batch or continuous. Facilitates the production of chloromines for sterilization.
N-Sol-B (U.S. Pat. 2,310,009)	Alum	Reactant readily available, inexpensive.
N-Sol-C (U.S. Pat. 2,567,285)	Chlorine	Reactant usually available where sterilization is normal practice.
N-Sol-D	Sodium bicarbonate	Used where a highly alkaline salt is desired. For boiler feed water where ammonia is not desired.

Activated silica sol is made in your plant from our N Sodium Silicate shipped in drums or tank cars.

Sample of N Silicate and data sheet on jar test procedure on request.

Philadelphia Quartz Company
1166 Public Ledger Bldg., Philadelphia 6, Pa.

N-Sol Processes
PQ SOLUBLE SILICATES

Dresser Appoints Evans

Dresser Manufacturing Division, Dresser Industries, Inc., Bradford, Pa., has announced the appointment of Charles H. Evans as Manager for water lines, penstocks, water and sewage treatment sales.

Prior to joining Dresser, Mr. Evans was Branch Sales Manager for Rensselaer Valve Company in Chicago. In this capacity he supervised sales in a nine-state territory.

He has been an active member in the Illinois section of the A.W.W.A.

Mr. Evans was graduated from Dartmouth College and is a native of Haverhill, Massachusetts.

Pierce Joins Dravo Corp.

Dravo Corp., Pittsburgh, Pa., has announced the appointment of Edgar M. Pierce to supervise the design, engineering and installation of Dravo Incinerators for municipal and industrial garbage, refuse and sewage sludge disposal.

Mr. Pierce joins Dravo after 22 years experience in various banches of engineeing, construction and administration of power plants, pumping stations, paper and board mills, textile mills, chemical plants, tanneries and incinerators.

A registered professional engineer in 12 states, he is a member of the American Society of Mechanical Engineer, Technical Association of Pulp and Paper Industry and the Air Pollution Control Association.

Bristol Appoints New Chicago, St. Louis Managers

The Bristol Company, Waterbury, Connecticut, has announced the appointment of S. E. Gewin as District Manager of the company's Chicago offices.

Mr. Gewin's successor as manager of the St. Louis office will be Walter Messner.

Mr. Gewin has been with the Bristol sales organization since 1937, when he became a field engi-

neer in the Philadelphia office. He later served in the Charleston, Pittsburgh, and Buffalo offices, before being promoted to District Manager of the St. Louis office in 1953. He is a graduate of the University of Alabama.

Mr. Messner has been regional field engineer in Tulsa, Okla. since 1943. He joined the Bristol sales force in 1940 in the New York office, after receiving his B.S. degree in Chemical Engineering from Brooklyn Polytechnic Institute.

Rockwell Promotes Three Key Sales Personnel

Rockwell Manufacturing Co., Meter and Valve Division, Pittsburgh, Pa., has announced the promotion of three key sales personnel.

Gilbert T. Bowman, General products manager, and J. W. Northcutt, Southern regional sales manager, have been named assistant vice-presidents, and will make their headquarters at the home office in Pittsburgh.

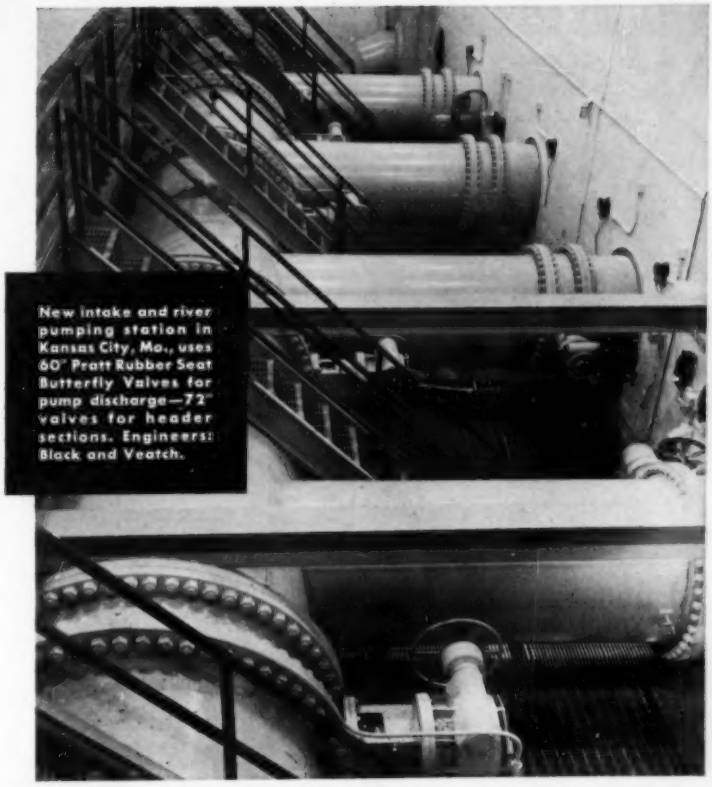
Mr. Jack H. Walters, product manager-petroleum and industrial liquid meters, will move to Rockwell's Southern regional headquarters in Atlanta, Ga., to succeed Mr. Northcutt.

Gladding, McBean To Build Vitrified Clay Pipe Plant

Gladding, McBean & Co., Los Angeles, Calif., has announced the immediate construction of a $5,000,000 plant for the manufacture of vitrified clay pipe in Bedford Canyon, California.

Located near a discovery of over a million tons of high-grade sewer pipe clay, the plant will house a 600-foot-long tunnel kiln. This kiln, plus ten periodic or "beehive" kilns will produce 6,000 tons of vitrified clay pipe per month when production is started in 1957. Full capacity will be 12,000 tons a month.

The group of buildings will include: bulk clay and grog storage bins, a grinding and screening building with two 10-foot grinding pans, a building housing 7 auger presses, 16 horizontal and vertical dryers, laboratories and offices, a lunchroom and locker building and a main office. Mercury vapor lighting will be used throughout.



New intake and river pumping station in Kansas City, Mo., uses 60" Pratt Rubber Seat Butterfly Valves for pump discharge—72" valves for header sections. Engineers: Black and Veatch.

KANSAS CITY:

Rugged efficiency in a minimum space

Look! A modern pumping station with compact, unobtrusive large-diameter valves that require no more clearance than a standard pipe flange, and operators that are equally compact. Face-to-face dimensions of these 60" and 72" diameter Henry Pratt Rubber Seat Butterfly Valves are only 15" and 18" respectively.

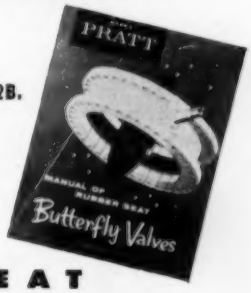
Specifying Pratt valves means important savings in space and installation costs—but even more important, economy through years of efficient maintenance-free operation.

Pratt originated the Rubber Seat Butterfly Valve and has installed more of them than any other manufacturer.

For valve design with a 50 year reputation for practical imagination, see Henry Pratt.

NEW! Latest, most accurate pressure drop and flow data, conversion tables, discussion of butterfly valve theory and application plus other technical information.

Write for Manual B-2B.



HENRY PRATT

RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

IN EVERY WAY
A SOUND
CHOICE . . .

Specify
IOWA
for . . .

Gate Valves
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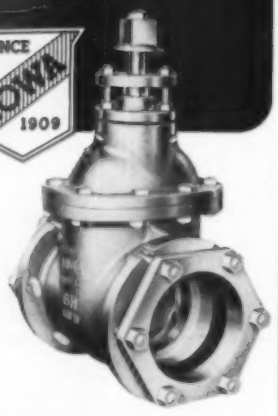
Indicator Post Valves
Square Bottom Valves
Hydraulic Valves
Motor Operated
Shear Gates
Fire Hydrants
Mud Valves
Flap Valves
Sluice Gates
Floor Stands
Valve Accessories

SINCE IOWA 1909



We manufacture complete equipment for water and sewage flow control in Filtration Plants, Sewage Disposal Plants and Pumping Stations. Specify Iowa and let us solve your problems.

IOWA
VALVE COMPANY
OSKALOOSA, IOWA
A subsidiary of James B. Clow & Sons

Arthur I. Schurtleff of Rockwell Retires

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced that Arthur I. Shurtleff, former cattle rancher and 34-year veteran of the water industry, retired as a water meter salesman for the company.

Mr. Shurtleff, a lifetime resident of Tulsa, began his career in the cattle business in 1915, then spent seven years—1921 to 1928—with the City of Tulsa Water Department.

He joined National Meter Company, Brooklyn, N. Y.—later acquired by Rockwell—as a water meter salesman in January, 1935, after seven years as a salesman for Worthington-Gamon Corporation.

A member of the Southwest and American Water Works Association since 1928, he has covered most of the Southwest during his meter sales career.

Dorr-Oliver Expands Field Engineering Division

Dorr-Oliver Inc., Stamford, Conn., has expanded its Field Engineering Division as a function of the newly established Sales Services Department. With the expansion, field engineers have been assigned to territorial areas generally coinciding with the D-O Sales Divisions.

Field Engineering area Supervisors are now located in the headquarters of the various domestic Industrial and Sanitary Division offices. This arrangement will provide close contact between Sales and Field Engineering and more complete, effective coverage of customer installations. Under the D-O system, field engineers are responsible for four major functions, each in degree varying with the particular installation. They include inspection of equipment after erection; supervision of erection; trouble-shooting and supervision of initial operation.

Skinner Expands Production Facilities

M. B. Skinner Company, South Bend, Indiana, has announced that work has begun on a new building that will increase present floor space by more than 30%. Besides providing expanded production facilities, the new building will house

for
Municipal Water
FLUORIDATION

INTERNATIONAL
HYDROFLUOSILICIC
ACID

Large tonnages
available at
REASONABLE COST

* International Hydrofluosilicic Acid runs typically 25% acid solution with a guaranteed minimum of 23% H_2SiF_6 by weight.
* Available in tank truck and tank car quantities.
* Shipments are currently being made from plants at Mason City, Iowa; Chicago Heights, Illinois; Lockland (Cincinnati), Ohio; Tupelo, Mississippi and Spartanburg, South Carolina. Other shipping locations will soon be available.
* With Hydrofluosilicic Acid, municipalities can save three ways: in cost of equipment installations, in material cost and in operating cost.
* Handling and control of material is simple and easy, with a minimum of space needed for storage.
* Liquid feed assures maximum safety for operating personnel.

If you are fluoridating now or planning to do so soon, it will pay you to talk with International's representative about the use, handling and costs of *Hydrofluosilicic Acid*. Please write or phone the office near you.

potash division
INTERNATIONAL MINERALS
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General Offices: 20 N. Wacker Drive
Chicago 6
61 Broadway, New York 6
Midland, Texas
Fulton National Bank Bldg., Atlanta, Ga.

a new and complete testing and development laboratory with adjacent engineering offices.

The company founded 58 years ago in Chicago, built its original South Bend Plant in 1928, and the company moved there in September of that year. A large warehouse addition was built in 1950.

Water Service Labs. Opens New Service Depot

Water Service Laboratories, Inc., New York, N. Y., has announced the opening of a new service annex which will provide expanded facilities for manufacturing and packaging water-treating chemicals.

The new 10,000 square foot plant, occupying the entire building at 609 West 131st Street, N.Y.C., released space in the firm's main building at 423 West 126th Street for enlarged laboratory facilities in which an increased program of research on water corrosion is now under way. Additional office space has also been provided.

Because of the specialized equipment required in the manufacture of water-treating chemicals, a 12-month program involving extensive alterations was necessary to ready the new service depot for operation. Facilities which had to be provided included underground storage tanks for chemicals, mechanical-blending apparatus, and automatic equipment for packaging solid chemicals.

A. M. Beyers Appoints Two Service Engineers

A. M. Byers Co., Pittsburgh, Pa., has announced that two new field service engineers have been assigned to the Company's New York Division office.

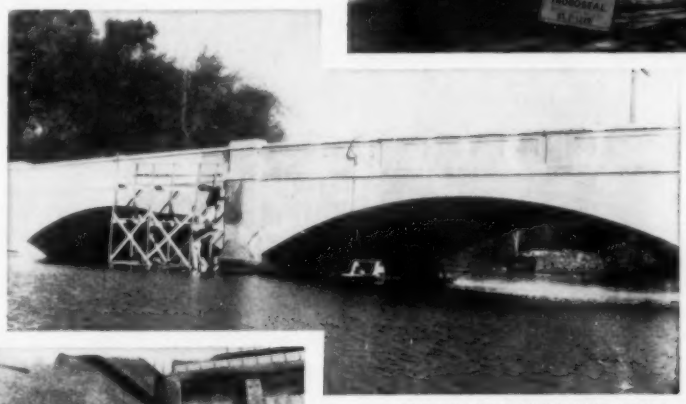
They are Paul A. Benoit of Cos Cob, Conn., and Albert L. Timm of Tuckahoe, N. Y. The New York office is at 30 Rockefeller Plaza.

Mr. Benoit was formerly associated with U. S. Gypsum Company, Inland Steel Products Company and Benoit Brothers. A four-year veteran of service with the U. S. Marine Corps, he received a bachelor's degree in liberal arts from the University of Miami.

Mr. Timm was employed by Ebasco Services, Inc., prior to joining Byers. He served with the U. S. Navy two years and received a degree in marine engineering from the New York State Maritime Academy.

It's *New Again* with THORITE and THOROSEAL

Freeze-thaw cycle following water and moisture penetration, also swelling of reinforcing rods from moisture contact, cause masonry destruction.



BRIDGE OVER CONCORD RIVER
ROUTE 3, BELLERICA, MASS.

Workmen on scaffold patch spalled and cracked concrete with THORITE and seal surface with THOROSEAL.

Area at left chipped to sound masonry. It will then be patched with THORITE *Nonshrink, Non-slump 20-Minute Set Patching Mortar*, without necessity of costly forming, finished by application of Thoroseal.

Request Circular No. 16 and 20.

Write for our 16 page "How to Do It"

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNSYLVANIA • CENTERVILLE, INDIANA

"Blow-Up Proof" Filter Bottom with UNIFORM Distribution

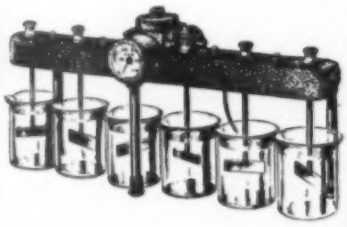
Criscrete

. . . Not a block system, but a span of reinforced concrete over entire filter bottom and only 6" deep. Easy installation and proven economy.

Write for field test data, installation list and brochure on Criscrete underdrain system.

M-C-G Company, 1771 W. 5th Ave., Columbus 12, Ohio

P & B Multiple Stirrer



When several samples are mixed simultaneously under identical conditions the optimum concentration of flocculent may be quickly selected and translated to plant quantities . . . The mixer takes 1,000 ml. beakers. Speeds from 15 to 100 r.p.m. are standard.

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P. O. Box 2V Richmond 5, Va.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

Synonym for...

PURE WATER

ROBERTS FILTER MANUFACTURING CO.
607 COLUMBIA AVE.
DARBY, PA.

W. E. Thomas Promoted By Homestead Valve

Homestead Valve Manufacturing Co., Coraopolis, Pa., has announced that Mr. W. E. "Bill" Thomas has been appointed Regional Manager for the valve division.

Mr. Thomas will manage and direct the training of valve specialists in the company's distributor organization within the eight southeastern states from Virginia to Mississippi. He will make his headquarters at 805 Church Street, Decatur, Georgia.

Dresser To Build Million Dollar Plant In Pa.

Dresser Manufacturing Division, Bradford, Pa., has just announced plans to build a new million-dollar plant in Wellsboro, Pennsylvania. Dresser's new plant will contain approximately 100,000 square feet of manufacturing space and will employ between 200 & 300 persons. The plant is scheduled for completion by early 1957.

Baldwin-Lima-Hamilton Expands Hydraulic Laboratory

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa., has announced a recently completed extension to its Eddystone, Pa., hydraulic laboratory to accelerate the research development program in the field of hydraulic turbines and pumps. The addition includes equipment which, for the first time, makes it possible to test runner models both as a turbine and pump under a complete range of operating conditions without changing the hydraulic set-up.

The expanded facilities extend the range of propeller runner research as well as that for the reversible pump-turbine, a design now showing promise of meeting certain applications on large utility systems.

W&SW

New Literature

Water, Sewage And Industrial Waste Treatment Equipment

1029

Jeffrey Manufacturing Co., Columbus, Ohio, has just published a catalog covering the complete line of **Jeffrey Equipment For Water, Sewage and Industrial Waste Treatment.**

This informative 64-page, 2-color catalog discusses everything from bar screens to sludge draw-off valves. Profusely illustrated with photographs and drawings, the catalog includes installation diagrams and performance tables. Divided into 6 sections, it discusses: Screens; Grit collectors and washers; Settling tank equipment; Floctrol process; Garbage grinders; and Auxiliary equipment. Photographs of actual installations using Jeffrey equipment are also included.

Valve Selection Charts

1030

The Kennedy Valve Manufacturing Co., Elmira, N. Y., has designed two **Valve Check Charts,** one for Bronze Globe Valves and one for Iron-Body Valves.

Each chart describes the basic gate, globe and angle check valve types and gives information on their design, operation, service characteristics and proper use. The charts contain special sections dealing with bonnet, stem and seat and disc types, materials and operating characteristics. A center section lists Kennedy manufactured valves, complete with working pressures, temperature ranges, sizes and figure numbers. Each chart is of standard calendar size and has a fastener for wall display.

Complete Motor Line

1031

U. S. Electrical Motors, Inc., Los Angeles, has just released a colorful revamped bulletin which now includes a more complete line of **U. S. Motors.**

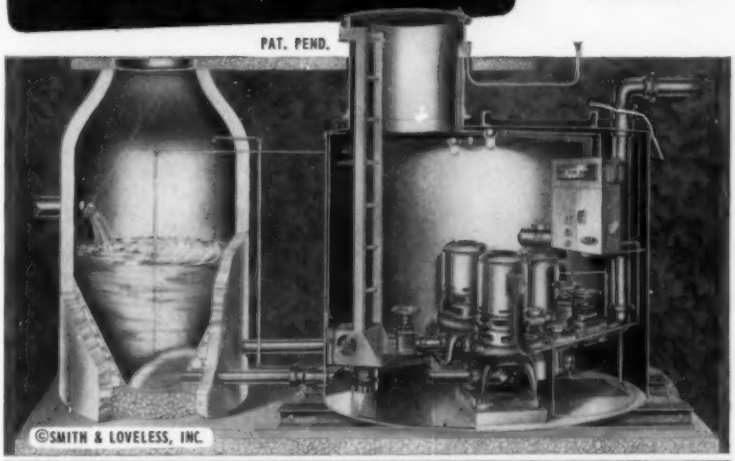
Descriptions and full-color illustrations are included of open-type Uniclosed designs, totally-enclosed and explosion-proof types, Varidrives, Syncrogears, and right-angle worm gear models; also vertical motors and Verticlosed hollow-shaft types.

HUNDREDS OF INSTALLATIONS—IN 27 STATES!

Specify—
The Smith & Loveless
FACTORY-BUILT PUMPING STATION

PROVEN QUALITY—WITH FACTORY-BUILT SAVINGS

PAT. PEND.



THE MOST ADVANCED DESIGN IN SEWAGE PUMPING STATIONS

We specialize in building America's finest sewage lift stations. Acceptance proves their quality. Smith & Loveless offer you a complete line of six standard size lift stations with capacities from 20 GPM to 1600 GPM per pump or ejector. Larger capacity stations are built to your order.

- An integrated design, each piece proven by the test of time.
- Precision assembled by factory experts.
- Automatic dehumidifier to eliminate condensation.
- A central electrical control cabinet prewired and color coded.
- Shot blasted steel structure epoxy coated plus cathodic protection.
- Factory tested and adjusted by actual operation before shipment.
- Easily and quickly installed.
- Especially designed for minimum maintenance.

For Job Recommendations, complete specifications, and drawings — all part of the latest edition of the 100 page Smith & Loveless lift station Data Manual . . .

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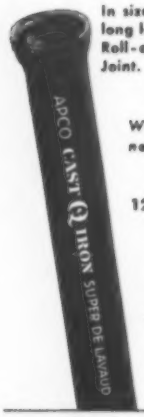
The easy jobs are never assigned to me. I can't lie around and take it easy, and I never get a rest. When I'm put into service I kiss the world good-bye, 'cause I'll be gone for a long, long time and there'll be no rest periods. Mine's the job that has to be done day and night for hundreds of years. But never worry . . . I'm Alabama's Super De Laveaud Cast Iron Pipe . . . I'll be rendering efficient and economical service when the others have dropped by the wayside.



In sizes of 3" to 24" in modern long lengths . . . Bell and Spigot, Roll-on-Joint and Mechanical Joint.

We invite inquiries to our nearest sales office—

122 So. Michigan Avenue
Chicago 3, Ill.

350 Fifth Avenue
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General Sales Offices.

ALABAMA PIPE COMPANY

ANNISTON, ALABAMA

Trenchers and Backfillers

1032

The Cleveland Trencher Company, Cleveland, Ohio, has just published a 4-page bulletin featuring the complete line of **Cleveland Trenchers and Backfillers**—including the recently introduced Cleveland L-270 ladder-type trencher. The L-270, one of the nine Cleveland models, is capable of digging wide deep trench in alleys and other narrow areas where no excavating machine of any kind heretofore could work.

Information on the capacities, specifications and dimensions of the nine Cleveland machines has been organized to facilitate a quick convenient comparison of the models. Special advantages and Cleveland design and construction features incorporated in each machine are covered in the brief text.

Butterfly Valves

1033

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has just published a bulletin on **Butterfly Valves** for water supply and disposal systems.

The bulletin describes A-C butterfly valves from 16 to 84 inch sizes and others especially suitable for water supply systems. In addition to general descriptions of the valves, the bulletin includes tabulations of pressure and velocity ratings available in each type. Also, application factors to be considered and information needed for prompt selection of the best valve for each application.

Pneumatic Operators

1034

Conoflow Corporation, Philadelphia, Pa., has recently issued a new bulletin on **Pneumatic Spring and Diaphragm Operators.**

The bulletin illustrates and describes Conoflow's Series B-10 and B-20 Spring and Diaphragm Conomotors, rugged versatile operators available from the factory in complete valve assemblies. The bulletin also shows the operator in various typical combinations with a butterfly valve, adjustable port valve, burner valve, etc.

Remote Control Systems

1035

The Sparton Control Systems Div., The Sparks-Withington Co., Jackson, Michigan, has just pub-

Sterelators by Everson

Chlorine Gas Control Equipment
Visible Flow Indication
Vacuum Solution Feed

for
Water Works
•
Sewage Treatment
•
Industrial Plants
•
Swimming Pools
•
Easy to Install
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Easy to Operate
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Low Maintenance Cost
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Everson STERELATORS can be furnished for fully automatic, semi-automatic and manual control.

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lished a 4-page brochure covering the plug-in package **Remote Control System** for two-position discreet operation of starters, pumps, valves, loaders, gates, operators, etc.

The brochure describes the system and the techniques, and how it can be used with existing equipment or controls.

Grit Collectors

1036

Chain Belt Company, Milwaukee, Wis., has available a bulletin on the complete line of **Rex Grit Collectors.**

Units for small plants, with a maximum flow of 1.5 MGD per channel, to units for large plants, with a sewage flow up to 40 MGD per channel, are outlined.

Also featured is the process of grit conditioning by recirculation to attain the less than 5% putrescible content.

Flight Collectors

1037

Walker Process Equipment Inc., Aurora, Ill., has just released an attractive 2-color, 24-page bulletin on **Flight Collectors** for rectangular settling basins.

Design data, detailed descriptions, specifications, photographs and drawings are included to present the complete story. Supplementary equipment such as: cross collectors, skimmers, and sludge draw-off valves are also described.

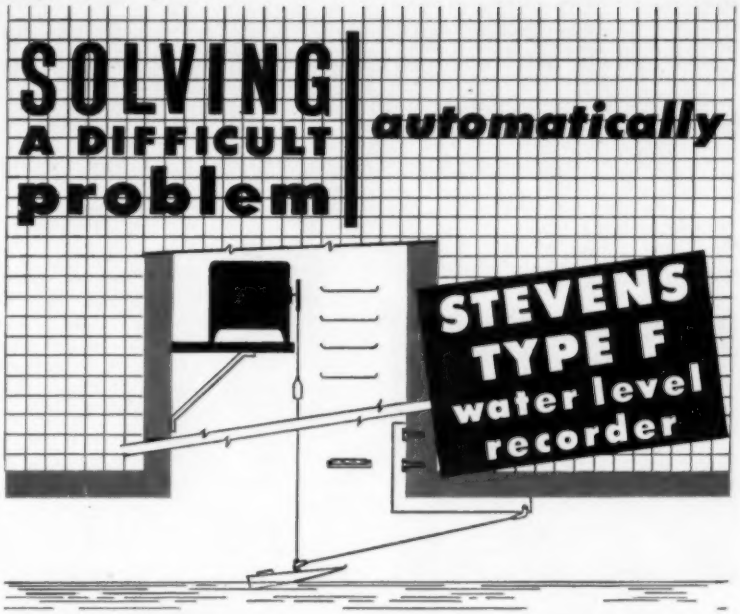
New Tubeseal Floating Roof Catalog

1038

Hammond Iron Works, New York, N. Y., has just published a completely new catalog and data book on the patented **Tubeseal System** for floating-roof storage tanks.

The new catalog describes the design and construction of the improved Hammond Tubeseal—the only floating-roof seal that completely eliminates every space between seal and product.

The Tubeseal, which is completely noncorroding, is fully illustrated in drawings and photographs. In addition, the new catalog contains a section giving detailed answers to all questions on the design, construction, materials, applications, operation, and advantages of the Tubeseal.



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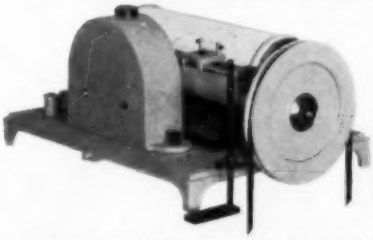

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Cradle-Mounted Centrifugal Pumps

1039

Ingersoll-Rand, New York, N.Y., has just released a Bulletin covering the complete line of class CRV **Cradle-Mounted Centrifugal Pumps.** Pumps described have capacities from 5 to 2800 gallons per minute and pressures of 10 to 525 feet total head.

A concise tabulation of pump types with their rating enables pump user to select the correct unit for his needs. A cross-section view points-up the design features comon to this line of pumps. The various models are described and their applications listed on individual pages of the bulletin. Typical installation views of the models are shown.

In addition, performance tables and dimensions for the entire line are shown. Two pages of the publication describe various modifications which are available for special applications.

High Capacity Flowmeter

1040

Fischer & Porter, Hatboro, Pa., has just published a new catalog describing the company's line of **High Capacity Variable-Area Flowmeters.**

The bulletin discusses how these meters are specially designed for those high capacity services where the advantages of linear flow output, wide range, and freedom from piping limitations are required. Maximum flow rates of 60 gpm to greater than 4,000 gpm can be handled in meters with 2-inch to 12-inch connections.

Emergency Power

1041

Detroit Diesel Engine Division of General Motors, Detroit, Mich., has just released a booklet entitled **"Emergency Power For Your City Water Works".**

The booklet outlines the importance of having standby power available to safeguard this vital activity and pictures Detroit Diesel installations already made throughout the country.

Paint Manual

1042

The U. S. Stoneware Co., Akron, Ohio, has published a new paint manual, **Tygon Protective Coatings.** This new manual is designed for use as a practical work book,

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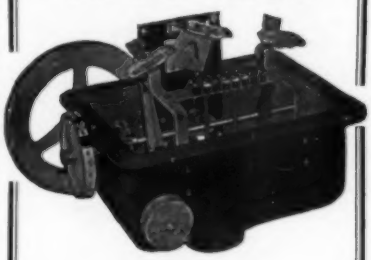

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The complete family of Tygon protective coatings and related primers are presented along with surface preparation, priming, application methods and maintenance instuctions. A table of chemical resistance and discussion of ATD hot spray paint are also given.

Pipe Cleaning Equipment

1043

Flexible Inc., Los Angeles, Calif., has available a catalog entitled **"Why Preventative Maintenance".**

The catalog describes the tools and methods used to meet all sewer maintenance and emergency problems. Profusely illustrated, the catalog shows by means of photographs and drawings each piece of equipment and how it is used. "Before and after" sequence photos are included along with photographs of material actually removed from the pipe line. Complete specifications and descriptions of accessories are also shown. The company's guarantee and a list of local distributors complete the catalog.

Revised Regulator Bulletin

1044

Rockwell Manufacturing Co., Pittsburgh, Pa., has just issued a revised version of the Rockwell '1001' Regulators bulletin.

The new features of the revised 12-page bulletin include: 1. Photo-illustrated descriptions of Rockwell's recently introduced 250-pound type high-pressure model of the '1001' which offers a maximum capacity of 200 psi and outlet pressure range from 5 to 60 psi; 2. Complete maximum capacity tables for all '1001' models along with explanations of the tables themselves and the ratings based on them.

Jointing Compound Bulletin

1045

The Atlas Mineral Products Co., Mertztown, Pa., has announced the release of a bulletin on Mineralead.

The bulletin gives complete information including estimating tables and directions for use of this hot-pour jointing compound for cast iron water pipe.

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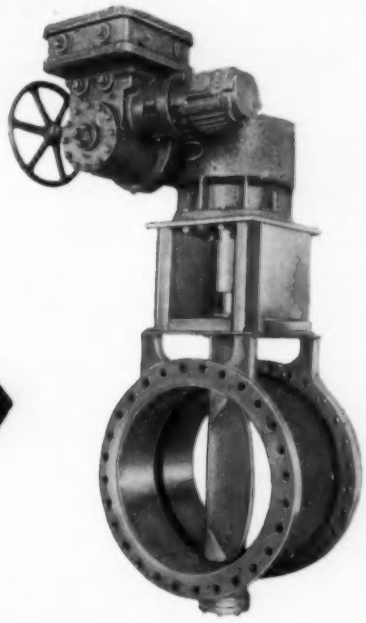

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New Addendum To Homomix Bulletin

1046

The American Well Works, Aurora, Ill., has published an **Addendum No. 1 to Technical Supplement HM** on the use of the American Homomix in continuous chemical mixing without a mixing tank.

This technical supplement addendum discusses the general theory of mixing, viscosity and fluid classes, continuous mixing vs. batch mixing, and the advantages of continuous mixing, with a table of comparison between Homomix and other pipeline mixers.

It also discusses typical Homomix capacities, materials of construction and linings, typical liquid and gas flows, lift stages, design modifications, typical applications and specifications.

Wound Rotor Motors

1047

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just published a bulletin describing the construction features of the Allis-Chalmers **Wound Rotor Motors.**

According to the bulletin, the motors are designed for use whereever high starting torque with low starting current is needed, power supply is limited, intermediate speeds are required, smooth acceleration is desired, or where high inertia loads must by accelerated.

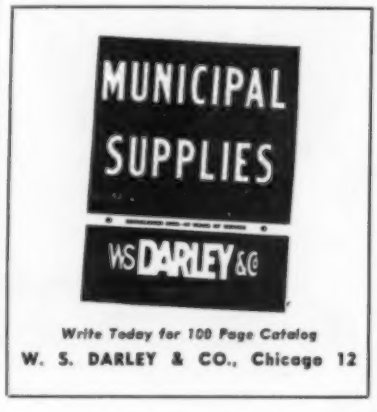
Line drawings show the various construction features in detail and actual installation photographs show the various applications.

Repair And Lining Of Sewers

1048

Pressure Concrete Company, Chicago, Ill., has released a folder on the repair and lining of **Sewers and Penstocks With Gunite.**

The 4-page folder photographically shows several installations repaired with Gunite; discusses how work done by the Gunite method lessens the time of shutdown in plant operations; and states how Gunite possesses resistance to sewage attack and lessens the possibility of future deterioration.



Enclosed Lineshaft Turbine Pump

1049

Layne & Bowler Pump Company, Los Angeles, Calif., has available a new bulletin in full color showing detail cutaway sections of all components of their **Verti-Line Turbine Pump,** enclosed lineshaft type. Designed for primary water supply, there are models for capacities from 20 to 10,000 GMP and pressures to 650 PSI. The bulletin illustrates and describes new Verti-Line Perihedral impeller seal that increases field efficiency and a new dual bowl bearing which combats abrasion. Bulletin opens to 45 inches with full length pump ilustration; large enough so the smallest part can be plainly seen.

Metering And Proportioning Pumps

1050

Hills-McCanna Company, Chicago, Illinois, has just published a twelve page, two-color booklet featuring Hills-McCanna **Metering and Proportioning Pumps** as used in Water Conditioning.

This booklet illustrates typical installations for the injection of inhibitors in water conditioning systems, using Hills-McCanna Proportioning Pumps. Included are complete pump specifications, a table listing the chemicals most commonly used in water conditioning, what they are used for, and the pump construction best suited to inject them.

Infrared Spectroscopy To Data Processing

1051

Scientific Instruments Div., Beckman Instruments, Inc., Fullerton, Calif., has just released a bulletin that features articles on **Infrared Spectroscopy and Data Processing.**

Featured are infrared articles on the new IR-4 double-beam, double monochromator infrared spectrophotometer plus unusual applications for the Beckman L/B infrared analyzers.

Other articles include a two-page spread complete with charts and pictures of 10 additional uses for Beckman DK recording spectrophotomers; how a DK-1 is used to detect potentially dangerous gases in the Cincinnati, Ohio sewerage system and a description of the new Beckman Electrolytic hygrometer—an instrument that can detect water vapor down to one part per million.

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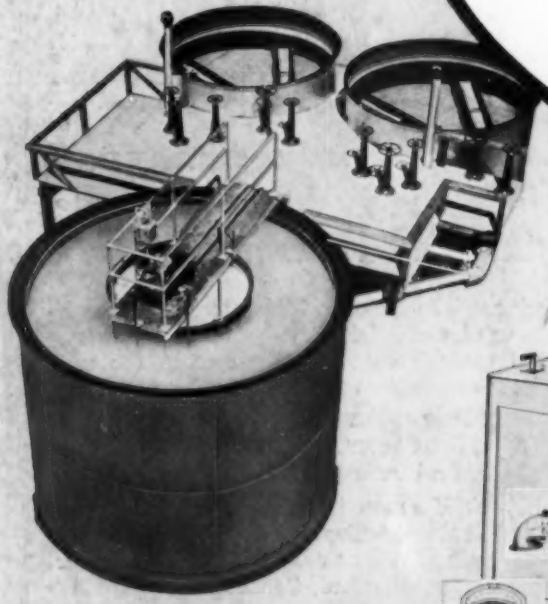

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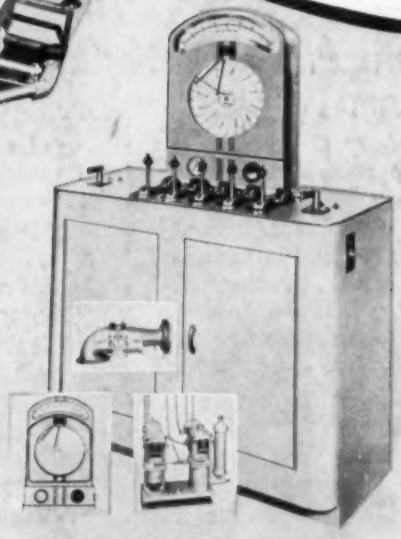

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